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ABSTRACT

This report presents examples of exemplary academic institutions that have achieved both a healthy environment and the goal of saving economically. Twenty-three public and private institutions' cost-effective environmental management stories are presented. Institutional size ranges from a few thousand to 40,000 students. Contents include: (1) "Transportation"; (2) "Energy Conservation"; (3) "Water Conservation"; (4) "Dining Services"; (5) "Re-Use"; (6) "Management of Hazardous Chemicals"; (7) "Composting"; and (8) "Recycling." (YDS)

A REPORT FROM THE NATIONAL WILDLIFE FEDERATION
CAMPUS ECOLOGY PROGRAM

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GREEN INVESTMENT, GREEN RETURN:

HOW PRACTICAL CONSERVATION PROJECTS SAVE MILLIONS ON AMERICA'S CAMPUSES



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LETTER FROM THE PRESIDENT

Dear Readers,

We all have heard the old adage, *The Future Is Now*. It's a phrase often used as a call for action. Nothing is more in tune with this message than our need to take action — now — in order to protect our environment, our natural world, and to ensure a sustainable future for our society.

We have learned a lot about sustainable practices since Earth Day 1970 raised public awareness about the costs and impacts of unchecked consumption and development. In the last few decades, new ideas have been tried, tested, discarded and perfected with regard to energy efficiency, waste reduction, pollution prevention and habitat protection. As institutions of higher learning, college campuses have been leaders in this sustainable movement, and they have served as critical laboratories for developing and testing new technology and ideas.

As the nation's largest conservation organization, the National Wildlife Federation's mission is to educate, inspire and assist individuals and organizations of diverse cultures to conserve wildlife and other natural resources and to protect the Earth's environment in order to achieve a peaceful, equitable and sustainable future. One important way we strive to meet this mission is through our Campus Ecology program. Since 1989, Campus Ecology has worked with students, faculty, administrators and facility managers in more than one-third of the nation's colleges and universities promoting and implementing campus conservation programs that can also be transferred to the broader community.

The nearly 4,000 college campuses across the country comprise a microcosm of American society. More than 14 million students attend 2 to 4 year American colleges every year. Almost all campuses contain offices, research labs, hospitals, residential housing, food services, roads, parking lots, sports facilities, theaters and preserved open space. Each year, colleges and universities spend an estimated \$186 billion and invest an additional \$75 million in endowment funds. Students themselves spend nearly \$45 billion annually. People who live and work in these institutions come from all walks of life and consume vast amounts of food, water, energy and other materials.

These institutions also produce vast amounts of pollution and waste. The opportunities for testing and perfecting new technologies and practices on campuses that can save energy, cut waste, curb pollution and educate a large, influential segment of the public is substantial.

We have learned, through our work with college campuses and other important institutions, that the most effective sustainable practices are those that are grounded in good science and good economics. Without these two critical elements, new environmental technologies and methods can fall short in motivating the larger public to embrace and adopt them.

I applaud Dr. David Eagan and Julian Keniry for their work in producing *Green Investment, Green Return*. This vital report shows that institutions of higher learning continue to be leaders in the sustainable field. But more important, the report clearly demonstrates that conservation practices that deliver substantial environmental benefits can produce substantial economic benefits as well. In case after case, this study illustrates meaningful, common-sense sustainable practices that significantly contribute to an institution's fiscal bottom line.

When it comes to the need for protecting our environment and natural world, the future is clearly now. The lessons presented in *Green Investment, Green Return* can and must be embraced by other segments of our society, if we are to be successful in moving toward a more sustainable way of life and a more sustainable future for our children. And in this noble quest, we will find that we will also save a lot of money.



Mark Van Putten

President and Chief Executive Officer
National Wildlife Federation



A REPORT FROM THE NATIONAL WILDLIFE FEDERATION
CAMPUS ECOLOGY PROGRAM
MARCH 1998

GREEN INVESTMENT, GREEN RETURN: HOW PRACTICAL CONSERVATION PROJECTS SAVE MILLIONS ON AMERICA'S CAMPUSES

by David J. Eagan, PhD and Julian Keniry

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The National Wildlife Federation Mission:

To educate, inspire and assist individuals and organizations of diverse cultures to conserve wildlife and other natural resources and to protect the Earth's environment in order to achieve a peaceful, equitable and sustainable future.

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THE BOTTOM LINE

A healthy environment or a sound economy? This choice, business and academic leaders are proving, is a false one. The fact is, most college and university conservation efforts actually improve financial and environmental performance.

This report highlights the pioneering work of academic institutions across the country that have achieved the twin goals of saving money and saving the earth. They have demonstrated, in theory and in practice, the compatibility of a healthy environment with a sound economy — two essential components of a sustainable future for people and nature.

The following 23 case studies highlight cost-saving conservation stories at 15 public and private colleges and universities, ranging in size from a few thousand to 40,000 students. Project categories include transportation, energy and water conservation, materials re-use and re-distribution, composting, recycling and management of hazardous chemicals.

Savings per project range from a little more than \$1,000 to around \$9 million per year. The combined annual savings realized across this sampling of projects is an impressive \$16,755,500. The cumulative savings over the years, of course, is even greater. For instance, the costs avoided through a variety of energy conservation projects implemented consistently over the years at the State University of New York at Buffalo exceed \$60 million.

The potential for cost-effective environmental improvement on college campuses is staggering. If the resource and financial savings these 15 campuses have realized were multiplied across the nation's 3,700 institutions of higher learning, the impact on the environment and on school budgets would be enormous.

If each campus, for example, secured merely one-tenth of the annual water savings achieved by Columbia University's recent retrofit program, the nation's colleges would collectively reduce U.S. water consumption by over 22 billion gallons a year. And if every campus reduced carbon dioxide

emissions by only one-tenth of what Cornell University has achieved through its transportation demand management programs, colleges and universities would prevent emissions of over 2.4 billion pounds of carbon dioxide into the atmosphere.

When the average savings of \$728,500 for the 23 projects highlighted here is multiplied across the remaining 3,685 colleges and universities, the savings top \$2.6 billion. Or, on a more modest level, if every campus in America realized the energy-related savings of the 2,000-student Elizabethtown College, the combined savings for all campuses would exceed \$900 million.

As the campuses featured here have realized, saving the environment can clearly save money and, whether viewed in terms of quantifiable benefits, such as dollars, gallons and tons, or considered in less quantifiable ones, such as setting a good example for students, the stakes of campus greening efforts are high.

Green Investment, Green Return stands as a challenge to higher education decision-makers and stakeholders not yet in serious pursuit of opportunities to improve their environmental and economic profile: To those readers the message is simply "get involved." Campus ecology can protect unique natural resources, conserve dwindling supplies of fresh, clean water, slash toxic emissions and train new generations of environmentally savvy citizens. What's more, such projects can yield a strong return on financial investment. If 15 colleges and universities can save and make nearly \$17 million over the course of 12 months, any institution can find its own approach to saving money by saving the environment.

ANNUAL REVENUES AND SAVINGS FOR 23 CAMPUS CONSERVATION PROJECTS

Conservation Projects

Annual Revenues and Savings

Transportation

Getting Students and Staff Out of the Car at Cornell University, NY	\$3,123,000
Creating a Bus-Riding Campus at the University of Colorado-Boulder, CO	1,000,000

Energy Conservation

Creative Strategies for Saving Energy at SUNY-Buffalo, NY	9,068,000
Lighting and Equipment Retrofits at Elizabethtown College, PA	247,000
A Four-Campus Energy Reduction Strategy at Brevard Community College, FL	2,067,000
Laboratory Renovations and More at Brown University, RI	15,500
Burning Better Lights in Dorm Rooms at Dartmouth College, NH	75,000
Solar Panels Generating Savings at Georgetown University, Washington, DC	45,000

Water Conservation

New Toilets and Water Fixtures at Columbia University, NY	235,000
Cleaning Up with Water-Saving Showerheads at Brown University, RI	45,800

Dining Services

Washable Cups in the Freshman Union at Harvard University, MA	186,500
Saving on Refillable "Red Mugs" at the University of Wisconsin-Madison, WI	11,400

Re-Use

Sale of Surplus Property at the University of Wisconsin-Madison, WI	241,800
Maintaining Vehicles with Re-Refined Motor Oil at the University of Illinois-Urbana-Champaign, IL	3,500
Second Time Around for Chemicals at the University of Washington, WA	14,400

Management of Hazardous Chemicals

Cutting Out the Weed-Killers at Seattle University, WA	1,300
Chemistry Classes with Fewer Chemicals at the University of Minnesota, MN	37,000

Composting

Creating Fertilizer with Kitchen Food Waste at Dartmouth College, NH	10,000
Composting Landscape Waste and Scrap Wood at the University of Colorado-Boulder, CO	1,300

Recycling

Award-Winning Materials-Recovery Program at the University of Colorado-Boulder, CO	107,000
Dining Services Recycling at Harvard University, MA	79,000
Getting Top Dollar from Paper Recycling at the University of Wisconsin-Madison, WI	120,000
Analyzing Wastes to Cut Costs at the University of Wisconsin-Madison, WI	21,000

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**TOTAL
\$16,755,500***

*See the introduction and individual program descriptions for more detail as well as the sidebars for descriptions of projects not included in this table.

PREFACE

David W. Orr

David W. Orr is Professor and Chair of Environmental Studies at Oberlin College and author of *Ecological Literacy* (State University of New York Press, 1992) and *Earth in Mind* (Island Press, 1994).

Within the lifetimes of students now attending college, world population is expected to double to 10-12 billion people, human actions will drive perhaps 20 percent of the species now on the earth into extinction, and the emission of heat-trapping gases will force global climate into a less stable and probably far less desirable state. Surveying these and other global trends, 102 Nobel laureates in sciences and 1,600 other scientists from 70 countries signed the World Scientists' Warning to Humanity (1992) which read in part:

Human beings and the natural world are on a collision course.... If not checked, many of our current practices put at serious risk the future that we wish for human society and ... may so alter the living world that it will be unable to sustain life in the manner that we know. Fundamental changes are urgent if we are to avoid the collision our present course will bring about.

We the undersigned, senior members of the world's scientific community, hereby warn all humanity of what lies ahead. A great change in our stewardship of the earth and the life on it is required, if vast human misery is to be avoided and our global home on this planet is not to be irretrievably mutilated.

The default setting — the momentum of our present course — is taking us where angels would fear to tread. But we have good alternatives. No problem mentioned by the World Scientists is unsolvable in principle, but these problems can be solved only if we have the wit and will to act with intelligence, foresight and dispatch.

For colleges and universities, taking long-term global change seriously would require careful reconsideration of campus operations and curriculum and how these two are related. In decades ahead, greater efficiency in the use of energy and materials will be essential to lower the environmental impacts entailed in the workings of large complex organizations and to reduce economic costs. Rethinking curriculum is essential to equip our students with the analytical tools and practical skills necessary to solve ecological and population problems looming ahead.

In fact this process is beginning. The case studies described here reveal what one hopes is a pattern of change that calibrates the operations of colleges and universities more closely with ecological limits and opportunities. Drawn from a variety of institutions, the cases describe instances in which the environmentally smart changes in operations were economically advantageous as well — once full costs were considered.

Where might such promising beginnings lead? Imagine colleges and universities with a commitment to operate so that they do not undermine the integrity, beauty and stability of the world their students will inherit. Could institutions of higher education lead in the transition to a new world powered by current sunlight? Why not? The limits are no longer technological or even economic, but those of imagination and commitment. Could they also establish a similar goal to eliminate waste in all of its forms? Again, why not? Through the imaginative commitment of purchasing and investments could they help leverage the emergence of sustainable regional economies? And could they incorporate such things into the curriculum in ways that cross disciplinary boundaries while having a practical effect on the world? Why not? Might

institutions of higher education imaginatively combine their interest in the long-term future with real institutional behavior and do so as part of a larger effort to teach their students that the world is indeed rich in good possibilities.

The larger goal, then, is not just to create "green" institutions, but to equip the emerging generation with the analytical skills and practical wherewithal necessary to lay the foundation for a better world than is now in prospect. To accomplish such things, they will need to know how to:

- Power civilization by a combination of high efficiency and technologies that capture sunlight, thereby reducing the likelihood of severe climate change.
- Reduce population growth while safeguarding basic human rights.
- Preserve species and entire ecosystems.
- Grow their food sustainably, which means preserving soils, groundwater, biological diversity and safeguarding human health.
- Eliminate waste and pollution.
- Restore degraded ecosystems.
- Develop economies that can be sustained within the limits of natural systems.
- Comprehend systems dynamics and long-time horizons.
- Create artistic and cultural symbols necessary to redefine the human role in nature.
- Create the political basis for an ecologically solvent democracy.
- Create a just distribution of power, wealth and opportunity in a world increasingly divided between rich and poor.

No generation has ever faced a more daunting agenda and more stringent deadlines, but none has ever had more resources with which to work either. One of the most powerful examples our students might have is that set by the very institutions purporting to induct them into responsible adulthood. This report describes cases in which there is a conjunction not only between economics and ethics, but between the practical world and that of learning as well.

CAMPUS GREENING PAYS OFF

There is a quiet revolution taking place at colleges and universities all across the country. This revolution, affecting the business of education from the classroom to the boiler room, is grounded in practical economics, prudent management and resource stewardship. Occasionally spurred by state and federal regulations, a trend of cost-effective campus greening has been initiated and is being advanced by an evolving environmental ethic.

As the revolution spreads, conservation has been embraced on a growing number of campuses as an increasingly important concept to be taught and modeled. And conservation has been accepted by those who run the calculators and fine pencil the budgets, for campus ecology programs, as this report illustrates, offer a strategy that can work for the environment, for education and for economics.

This report highlights a new kind of success story on college and university campuses: success at achieving the twin goals of doing the right thing for the environment and saving money. Simultaneously conserving both natural and financial resources is the holy grail of the campus environmental movement, and many forward-looking institutions have aimed for this dual goal. The case examples profiled here have either had notable success in reaching this aim or have kept detailed and convincing records that document their achievements.

Wasting the Environment Wastes Money

In many ways, the nation's 3,700 colleges and universities hold a mirror to American society. As colleges instruct and prepare tomorrow's leaders, they spend billions to build and maintain offices, research labs, hospitals, housing units, food services, roads, parking lots and recreational

facilities. In doing so, they burn fossil fuels, generate tons of trash, flush away thousands of gallons of water, buy products that perpetuate pollution, produce hazardous waste and destroy important plant and wildlife habitat to accommodate the ever-present automobile.

In too many instances, educational institutions have been teaching environmental management in the classroom while they have been polluting the water and air, contributing to global warming, wasting non-renewable resources and stressing local ecosystems. But what was and still is in some places, does not have to be.

From Hanover, New Hampshire to Mesa, Arizona environmentally-conscious innovators have launched programs to improve environmental performance and to satisfy the hard, cold bottom-line accounting of colleges and

universities. Often working outside of the limelight, inspired students and motivated campus personnel have joined together to put environmental stewardship and prudent economics in sync.

In addition to providing environmental and economic benefits, campus greening can yield extraordinary educational dividends. Many of the people whose decisions will profoundly affect the future of the planet today attend America's colleges and universities. With yearly enrollments now topping 14 million, the potential for influencing tomorrow's executives, teachers, politicians and global decision-makers is enormous. Collaborative efforts of students, faculty and staff in campus-related environmental projects can provide valuable hands-on lessons about solving problems in the real world — lessons that cannot be replicated in lectures or readings. And by acting as good environmental citizens, colleges and universities can model the kinds of behaviors and attitudes that encourage environmental responsibility in employees and graduates.

*In many ways, the
nation's 3,700 colleges and
universities hold a mirror
to American society.*

The Challenges and the Opportunities

As this report clearly shows, there are lessons to be learned and there is money to be saved and made in protecting the environment. With careful decisions, creative budgeting and long-term thinking, environmental protection can cut costs and even generate revenues for school operations.

A solid, long-term commitment to energy conservation, for example, has saved the State University of New York at Buffalo more than \$60 million and prevented the release of no less than 32,000 tons of global warming gases and air pollutants. The University of Colorado's award-winning recycling program has diverted nearly 10,000 tons of waste from local landfills and earned more than \$500,000 in revenues. With a transportation program that boasts a cumulative savings of \$13,000,000 from 1991 to 1997, Cornell University commuters save 417,000 gallons of fuel annually and keep 6.7 million tons of carbon dioxide, 651,000 pounds of carbon monoxide, 34,000 pounds of nitrous oxide and 59,000 pounds of hydrocarbons from fouling the air each year.

The project possibilities are wide-ranging. For most campuses, reduced energy consumption has proven to be the most frequently employed and the most lucrative campus greening project. Indeed, a few years ago, Amory Lovins, renowned energy expert and Founder of the Rocky Mountain Institute, estimated that simply by using off-the-shelf technology, colleges and universities could cut their energy bills in half. When it comes to retrofits of lights, motors, windows and fume hoods, the costs of inaction are often surprisingly high.

In the parlance of the times, there are still a lot of "no-brainers" waiting to be tackled — investments that can be made with high assurance of quick payback. But there are many more projects that are hard to sell, entail longer payback periods,

involve political struggles and carry large, up-front price tags. The campus case stories reviewed here range from simple "low-hanging fruit" projects (such as installing low-flow showerheads) to complex, multi-level initiatives that call for cross-department collaboration, sizable loans or financing and delicate negotiation.

Some projects recounted here initially met with resistance, for the conventional wisdom says that protecting the environment costs rather than saves money. As campus and department budgets are whittled away, new ideas that cannot pay for themselves are quickly put aside. This comment

from a university fleet supervisor during an interview is typical:

We want to do the right thing ecologically, but on the other hand we have to be prudent economically or we will cease to exist.

Making the case that an environmental initiative can save money, or at least break even, may open minds, but in some instances there will still be a hesitancy to stray from the tried and true. Many of the pioneers associated with the projects in this report initially encountered that frustrating institutional inertia, but their persistence and determination made the difference.

We want to do the right thing ecologically, but on the other hand we have to be prudent economically or we will cease to exist.

About This Report

The case stories that follow were selected to represent a wide variety of successful cost-saving campus projects. Both public and private institutions are included, ranging in size from a few thousand to 40,000 students. Project categories include energy and water conservation, dining services, recycling, re-use, composting, transportation and management of hazardous chemicals. Savings per project range from a little more than \$1,000 to around \$9 million per year. In all, 23 projects at 15 campuses are profiled in this report, demonstrating a total annual savings of no less than \$16,755,500. Cumulative savings for many projects are even more impressive.

For a few institutions, two or more separate stories are given to show the range of activities that can occur on a single campus. Some schools, such as Brown University and the University of Colorado, could have provided dozens of stories. Indeed, most campuses probably have multiple cost-saving stories to tell. The examples included here offer only a glimpse of what is going on around the country.

Each tale, though briefly told, is meant to convey the key components of a particular project and present its boiled-down economics to the extent that documentation allows. For ease of comparison, all of the stories of environmentally-motivated campus projects in this report list the annual cost savings or revenues. Some conservation efforts — especially those dealing with energy and water — reduce costs over extended periods. After paying back the initial investment in efficient new fixtures and equipment, these utility-conserving initiatives rake in "savings" over time, and the cumulative savings in those cases can be enormous. Others, such as the Surplus/SWAP program at the University of Wisconsin at Madison, actually make

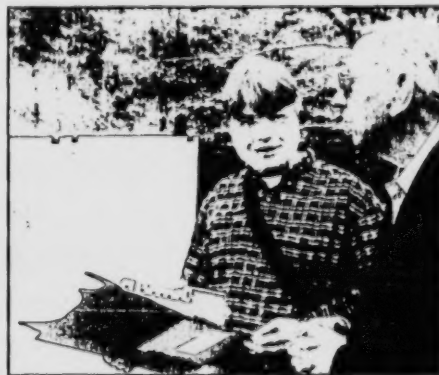


money right off the bat. For a snapshot of the range of projects and the magnitude of their savings, see the summary table.

There are also many projects that everyone believes are cost-effective but for which hard data are simply not available. Some grounds personnel, for

example, "know" that they purchase smaller quantities of pesticides than they did in the past, but detailed purchase records are not available. Insufficient documentation prevents a number of stories from being included here. A few campus stories are presented in sidebars, because specific savings numbers were unavailable. In one instance, before-and-after measurements of water used for irrigation were not available. In another, historical purchase data exists but sits in relatively inaccessible archive files. For these and other reasons, the refrain, "I know we are saving money, but I just don't know how much," was heard from many college employees. All the same, such work has led to valuable, if uncounted, savings and reduced the use and abuse of natural resources on many campuses.

In addition, many worthwhile conservation initiatives do not save money. A junk-mail reduction strategy at Dartmouth College, for example, resulted in a big decrease in mail-order catalogs that arrived on campus. This was a welcome development for students and the environment, but it did not demonstrably cut any costs.





Because the information provided in this report is extremely brief, it may be necessary for some readers to search out a fuller account. Each story includes a contact name and phone number. One word of caution is in order: People change jobs, files get lost or archived, and what works on one campus may not work on another.

In general, this report confirms that saving money is not a cookbook process. Local solutions to local circumstances are always needed. Would-be campus ecology activists can learn a great deal from personal networking and from exploring the print and electronic resources in the report's bibliography. In addition to offering dozens of ideas for conservation and environmental projects, some resources provide case examples in great detail. The Internet has also become a vast storehouse of information on campus greening projects: Brown University, SUNY-Buffalo and many other colleges and universities have posted environmental policies, student reports, curriculum strategies and project data on-line.

The stories shared in this report are meant to inspire and engage more people in the effort to make America's campuses sustainable — environmentally and financially. Hopefully, one critical lesson will stand out: The time to start is now. The environmental, economic and educational costs associated with inaction are far too high. **Acting now is money in the bank.**

1. TRANSPORTATION

The environmental costs associated with current modes of transportation are profound. The standard internal combustion engine contributes significantly to air and water pollution and is a leading culprit in the United States' dubious distinction as the largest contributor to global carbon dioxide emissions. The environmental imperative for higher education to address the transportation issue is as great as the issue is difficult. Nonetheless, most campus debates on transportation tend to revolve around one thing: a perceived shortage of parking spaces.

As in the corporate world, increasing numbers of faculty, staff and students commute from increasing distances, putting pressure on the fixed capacity of on-campus parking. Conventional supply-side solutions to such shortages generally favor increasing the number of spaces, which can cost up to \$25,000 per space. Surface parking lots are cheaper to build than ramps, but issues of cost, congestion, maintenance and competing land-use priorities still make these parking expansion projects troublesome at best.

Today many colleges and universities are exploring the more cost-effective solutions that arise from demand-management strategies. Existing parking spaces will suffice, goes the logic, if they can be more creatively assigned and if more commuters carpool, ride bikes or take public transportation. Another solution involves the location of the campus itself. By choosing the conversion of downtown warehouses over new suburban construction, for example, the University of Washington-Tacoma not only encouraged the use of public transportation but also helped to revitalize the downtown area.

Unlike most other conservation initiatives on campus, the "greening" of transportation primarily involves changing human behavior, not simply substituting a better technology. Low-tech alternatives for cutting parking problems are easy to propose: The challenge lies in making those greener options acceptable to the diverse commuting clientele of the campus.

In achieving their outstanding results, the campuses featured below placed emphasis on different audiences and modes of transportation — at UC-Boulder students and buses were the focus; at Cornell the emphasis was on staff and carpooling. Other campuses, such as the University of South Florida, featured in a sidebar, have run amazing experiments with their vehicles. And still others, such as the University of Illinois, featured elsewhere, have made a variety of changes to green their fleet maintenance and repair shops, including using recycled motor oil.

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Creating a Bus-Riding Campus

University of Colorado

Prompted in part by the huge expense of building two new parking garages, a partnership of City officials and University of Colorado (CU) administrators and students decided to try an alternative. Their collaboration resulted in a student bus pass program — one of the few in existence at the time, notes Will Toor, Director of the Environmental Center. Students were deeply involved in planning the program, and

support for the program, students voted 15-to-1 in April 1997 to raise the semester fee to \$19.42, thus generating \$1 million a year for investment in alternative transportation.

A steady rise in bus ridership demonstrates the program's popularity. In the 1991-92 school year, students took the bus to campus 300,000 times; by 1996-97 student rides numbered 1,500,000. A 1995 survey found that students used bus passes for around 5,000 trips each day and that 30 percent of those trips would likely have been in single-occupant vehicles. The bus program has eliminated the need for an estimated 750 parking spaces. If those spaces had been built, at a cost of \$8,000 to \$12,000 each, the University might have spent as much as \$9 million. The associated annual cost savings of the bus program alternative were estimated at around \$1 million, and that figure excludes the substantial costs for operation and maintenance of parking structures.

This kind of information and long-term cost projections convinced Parking Services Director, Joe Roy and the Vice Chancellor's office of the value of developing a similar bus pass program for faculty and staff. Launched in late fall 1997, the new initiative is expected to cut traffic congestion and reduce parking demand by approximately 400 spaces. The savings from this avoided construction will add an estimated \$1 million to the overall savings attributed to the student program. The savings from both the student and faculty/staff bus pass programs are speculative, Toor emphasizes, but given the rise in demand for parking on campus, the combined benefit of both programs is a clear time delay before another parking garage must be constructed.



Will Toor, UC - Boulder

their key achievement was convincing the CU student body to tax itself to fund the program.

By paying initial fees of \$10 per student per semester, CU's 25,000 students were able to ride local buses for free, anytime. The program has grown in six years and students can now ride certain regional buses for free and take low-fare buses to area ski resorts. In a convincing show of

Student Bus Pass Program

Cost Savings

Annual cost of <u>bus program</u>	Number of parking <u>spaces avoided</u>	Total cost of building <u>new ramp spaces</u>	Annual <u>cost savings</u>
\$1,000,000*	750	\$6-9,000,000	\$1,000,000

*Paid for by a \$19.42 fee per student per semester in 1997-98.

The CU program illustrates not only that parking alternatives can save a substantial amount of money but also that transportation is an issue that the campus community can get passionate about. "I'm convinced that transportation could be the campus operational issue of the next decade," says Toor, "analogous to recycling in the last decade." Transportation, Toor notes, offers a unique convergence of interest groups — university administrators seeking to contain costs, student environmental activists interested in conserving resources and reducing pollution, and municipalities concerned with managing the stream of cars into and out of colleges.

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Transportation, Toor notes, offers a unique convergence of interest groups — university administrators seeking to contain costs, student environmental activists interested in conserving resources and reducing pollution, and municipalities concerned with managing the stream of cars into and out of colleges.

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Getting Students and Staff Out of the Car

Cornell University

When confronted with a 2,500-parking-space shortfall for staff and student commuters, Cornell University faced a major fork in the road. The University could add more spaces — by building on or paving several acres — or it could figure out other ways to get the University's 9,000 faculty and staff to and from work. The University chose the second option, and in doing so Cornell has spent an estimated \$13 million less than it would have if it had chosen to build new parking capacity. The biggest cost-saver was avoiding construction of 1,200 new parking-ramp spaces at a cost of \$12,000 each.

Cornell's Transportation Demand Management Program (TDMP), created in 1991 to address the parking problem, proposed a number of alternatives to transportation by single-occupant vehicles. These

included the OmniRide bus pass system and RideShare groups. Under the OmniRide program, staff and faculty can ride City and County buses anytime for free. The RideShare program, which is used by 1,400 employees, offers several perks. If a car carries a certain number of people, it may qualify for a discounted permit fee or even a rebate. Also, reserved parking spots are provided free for vehicles that carry a sufficient number of riders. Overall, TDMP's proposals have resulted in a 25 percent decline in the number of faculty and staff vehicles coming onto campus.

Only about 350 new parking spaces have been built over the years, which is considerably less than the 3,100 spaces that would have been constructed since 1991 without TDMP's innovations. In all, approximately 3,000 faculty and staff participate in some aspect of the program. TDMP has won several awards which, along with its ongoing savings, offer proof that its creative solutions to rising transportation demand are really working.

Alternatives from the Transportation Demand Management Program

Cost Savings

Six-year costs
for TDMP
\$1,368,000*

Cumulative
savings 1991-1997
\$13,000,000

**Annual
cost savings
\$3,123,000****

* Program cost has risen from \$206,000 in 1991-92 to \$256,000 in 1996-97.

** For 1996-97 school year. This includes a \$2 million savings carried over from 1993-94 when construction of a major parking ramp was avoided because of TDMP. Annual savings have risen by about \$112,000 each year as a result of having to build far fewer spaces than would be needed per year without TDMP.

Transportation Communications Manager, David Lieb, working with University engineers, calculated another set of savings attributable to the program. Due to the alternatives to single-occupant vehicles, commuters drive 10 million fewer miles to and from Cornell each year. This translates into many environmental benefits, including saving 417,000 gallons of gas and preventing 6.7 million pounds of carbon dioxide from being released into the atmosphere. In addition, Lieb emphasizes, because the University is committed to "being a good neighbor," the effort expended to reduce traffic volume on campus and in surrounding neighborhoods has been a good investment.

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Refueling with the Sun

University of South Florida

When engineer George Moore retired from a career in the energy utility business, he turned his interest in electric vehicles into a second career. With funds from the U.S. Department of Energy and the Florida Energy Office, he established and now directs the Clean Energy and Vehicle Research Center in the School of Electrical Engineering at the University of South Florida. Although his research focuses primarily on the technical aspects of clean vehicles, a 12-vehicle "PV Carport" with movable photovoltaic panels on the roof allows his team to investigate the benefits of solar power as well.

The Clean Energy Center has a fleet of electric vehicles that are recharged using the PV array. New technologies allow them to draw direct current (DC) electricity from the panels to charge the vehicle batteries. In addition to providing fuel cost savings, the PV Carport serves as a popular teaching tool for the engineering school and for visitors to the campus.

Most campuses need some sort of financing assistance to capitalize a PV project, he notes, but once in place "it's really gravy at that point." Solar power may seem like a sure bet for places like Florida, Moore says, but in reality Florida's clouds, high humidity and salty air reduce both the efficiency and the life-span of PV panels. As researchers find ways to reduce costs and raise efficiencies, however, photovoltaics will become an attractive supplement to campus energy needs.

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2. ENERGY CONSERVATION

Energy — it warms the dorm rooms when the chill sets in, cools them when temperatures rise; it keeps the classrooms bright, runs the computers, cooks the food and lights the scoreboards. On any campus, providing and managing energy is a huge and multi-faceted task, typically consuming about 30 percent of an institution's operations budget.

At one time, energy was cheap, and in that era many campuses invested in excess lighting, inefficient machines and operating systems, and energy-wasting buildings. But when the price of energy rose precipitously in the mid-70s, these seemingly "cheap" investments began to cost dearly and many schools, businesses and other institutions began experimenting with energy conservation. In most instances, when costs declined again, conservation returned to the back burner.

In the 1990s, however, with new super-efficient, off-the-shelf technology available, a second wave of energy conservation has begun, prompted this time not by rising energy prices but shrinking school budgets.

A few campuses have taken on long-term, comprehensive energy conservation programs. They have invested millions of dollars and over time saved many millions more. Other schools have introduced retrofits, such as lighting or electric motor replacement, or installed new energy-saving technologies such as motion-detectors to control lighting and advanced computerized HVAC (heating, ventilation and air conditioning) controls. The following examples show cost savings achieved by large as well as small scale initiatives at a variety of types and sizes of campuses, including large public and private universities, a multi-campus community college and a small private college.



Brevard Community College

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Creative Strategies for Saving Energy

State University of New York (SUNY)

Technical descriptions of the energy projects undertaken at SUNY Buffalo (UB) could fill half a

book. The book's equally important other half would outline the strategy, vision and passion of Walter Simpson, UB's long-time Energy Officer. Energy conservation at UB is a central tenet of smart operations as well as a matter of principle. A recent report sums up this dual mission:

Energy efficiency became a priority that has provided the campus with attractive returns on investment while fulfilling a moral obligation to use energy judiciously. Furthermore, the process of retrofitting the campus has educated its student body,

faculty and staff on the importance and potentials for efficiency.

Energy efficiency became a priority that has provided the campus with attractive returns on investment while fulfilling a moral obligation to use energy judiciously. Furthermore, the process of retrofitting the campus has educated its student body, faculty and staff on the importance and potentials for efficiency.

UB began cutting energy use and costs in response to the 1970s energy crisis, but in 1982 when Simpson was hired, conservation efforts took a quantum leap. Simpson initiated a program called "Conserve UB" that has implemented more than 300 energy-related retrofit projects, including installing efficient lights and motors, weatherizing buildings and modifying heating, ventilating and air conditioning systems. It has also focused on modifying human behavior by communicating, in a variety of creative ways, the importance of energy efficiency to the campus community. One recent campaign focused on promoting "green computing" habits and purchasing practices that save energy and paper and promote recycling.

With the assistance of CES/Way International, an energy service company based in Houston, Texas, and using utility rebates and incentives, UB took on an additional comprehensive energy retrofit program at a cost of \$17 million. The multi-year project is responsible for reducing UB's energy costs by almost 15 percent or \$3 million each year — on top of an annual \$6 million of savings from other energy conservation projects. The payback period on the investment for the project, given utility incentives, is only 3.76 years.

Conservation measures implemented before the CES/Way project enabled UB to hold energy consumption constant on one of its campuses while constructing 6 new buildings and expanding the size of the campus by 20 percent. Through 1996, UB's cumulative energy cost savings have been estimated at more than \$60 million.

Comprehensive Energy Retrofits

Cost Savings

Total CES/Way project costs	Annual savings from CES/Way	Payback period	Other annual savings	Total annual cost savings
\$17,000,000	\$3,000,000	3.76 years	\$6,000,000	\$9,000,000

UB has also cut its pollution load substantially. According to an engineering analysis, the CES/Way project alone will reduce annual campus emissions as follows:

Carbon Dioxide	63,418,000 pounds
Sulfur Dioxide	140,000 pounds
Nitrous Oxide	214,000 pounds

Not surprisingly, the project was awarded the 1997 Energy Project of the Year by the Association of Energy Engineers.

Overall, explains Simpson,

"We make sure that energy cost reductions on campus correspond with declines in BTUs or kWhs. It's important to focus on both dollar and energy savings to make sure your energy program produces environmental benefits while helping the financial bottom line. In this way, an institution can meet its obligations for prudence and for environmental stewardship."



Walter Simpson, State University of New York

"We make sure that energy cost reductions on campus correspond with declines in BTUs or kWhs. It's important to focus on both dollar and energy savings to make sure your energy program produces environmental benefits while helping the financial bottom line. In this way, an institution can meet its obligations for prudence and for environmental stewardship."

Photo by
James Ulrich

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Lighting and Equipment Retrofits

Elizabethtown College

When Director of Plant Operations Larry Bekelja arrived on the Elizabethtown College campus in January 1992, he inherited a 55-person staff and a facilities situation in need of major changes. Five years later, with the same number of staff and a campus expansion of 17 percent, he had cut 20 percent from his 1992 budget yet provided a vastly improved quality of service. Starting in 1996, in one of his largest projects, Bekelja undertook a major replacement of lighting fixtures and other equipment for a net annual savings of nearly a quarter of a million dollars.

With similarities to SUNY-Buffalo's most recent round of energy conservation projects, the \$1.8 million project is financed by a tax-free bond issue, brokered through a performance contract underwritten by a major energy consulting firm. Recognizing the sure-fire savings linked to the project, the energy firm helped overcome administration skepticism by guaranteeing the 10-year payback of the borrowed money. One-third of the

project funds went into replacing 9,000 lighting fixtures. Other retrofits included replacing ten boilers, five large water heaters and four rooftop HVAC units with efficient gas-fired equipment. Improvements also included an upgrade of the computer control system that manages and tracks energy use on campus. And the campus has recently invoked a moderate thermostat policy, setting a ceiling of 70 degrees Fahrenheit in the winter and a floor of 75 in the summer.

One and a half years into the 10-year contract, Bekelja reports that the College is more than meeting its anticipated savings goal, adding to the \$95,000 annual savings already realized from a dozen previous initiatives. Despite constant, "locked-in" rates, energy costs on the 800,000-square-foot campus have dropped from \$1.43 per square foot in 1996 when the new project began to \$1.10 today. Coming from a long career in industry, Bekelja is quick to identify major savings opportunities. "We are not, by any means, done," he says. His aim is to cut energy use to the equivalent of \$1.00 per square foot at constant rates.

Performance Contract Energy Savings Plan

Cost Savings

Total
project cost
\$1,835,000

Annual cost
savings guaranteed
\$247,000

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A Four-Campus Energy Reduction Strategy

Brevard Community College

Dubbed "the energy miracle" by local utility Florida Power & Light, Brevard Community College (BCC) has completed a wide variety of energy-conserving projects. Beginning in the early 1980s, the College teamed its financial leaders with an inventive facilities staff, challenging them to cut energy costs at BCC's four campuses. Since then, BCC has sustained an innovative edge in energy conservation. From 1982 to 1989, BCC's annual energy bill increased by only \$1 during a period when campus building space and inflation grew by 25 percent.

Brevard has continued to grow, doubling building space from 800,000 to 1,600,000 square feet since 1982. Keeping track of cost-cutting opportunities and projects amidst this growth is a big job, especially across four campuses. Harold Creel and Virgil Fulford, chief administrators of Operations and Maintenance, oversee the day-to-day design and implementation of energy-conserving initiatives and help identify new possibilities.

One recent effort was the replacement of all fluorescent light fixtures on BCC's four campuses. Energy-efficient T-8 fixtures — 10,000 in all — replaced a variety of older less-efficient models. With all fixtures now requiring the same bulbs and ballasts, Fulford reports new efficiencies in purchasing and maintenance. Annual savings for that project are around \$300,000, with a payback on initial

investment of less than 3 years. Electrical demand for the lighting has been slashed by 40 percent.

According to Steve Megregian, Brevard's Vice President for Business and Financial Affairs, the College also achieved significant savings by installing computer-controlled energy management systems on all campuses, retrofitting parking lot lights and hooking up motion sensors to classroom lighting.

On the Melbourne campus, a new chilled-water air conditioning system added another \$150,000 a year to the savings total. "Air conditioning," Megregian quips, "is kind of a big issue down here." The College saves money with the Melbourne system by chilling water at night when electric rates are lower, then circulating the cold water during the day. The reduction in electrical demand during peak hours not only saves the campus money but also forestalls the need for Florida Power and Light to build a new power plant to meet spikes in demand.

Construction will begin soon on a gas-fired chiller at the main campus in Cocoa. The conversion to gas will allow the College to further reduce electrical demand. This will save BCC money because gas is cheaper in summer when cooling loads are highest, due to dramatically lower demand for gas in the summer. While fuel switching is not necessarily an energy conservation measure, gas-fired cooling can save energy compared to electrical cooling, when point-of-generation power plant inefficiencies are taken into account. Gas-fired cooling may also produce less overall air pollution.

Multi-Campus Energy Conservation

Cost Savings

Kilowatt hours <u>reduced</u>	Total cost <u>savings to date</u>
257,143,000 kWh	\$14,400,000

Annual cost savings \$2,067,000*

*1997 figure.

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Burning Better Lights in Dorm Rooms

Dartmouth College

The path to energy efficiency at Dartmouth College is turning out to be a prosperous one despite an early, unexpected detour.

When Dartmouth College replaced thousands of incandescent ceiling lights with "circleline" fluorescent fixtures in the 1980s, the new fixtures saved energy in the short run but actually led to a rise in electrical demand. Students quickly began to supplement the new "night lights" — as they called them — with additional lamps. When halogen "torchier" lamps drawing from 300 to 500 watts became popular among students, they sent the electric meters spinning. Halogen torchieres were eventually found in more than 70 percent of student rooms.

Before restricting the use of halogen torchieres, Dartmouth's Residential Life Operations (RLO) decided to test student preferences, select new lighting and bring all residence hall lights to levels acceptable to the students. By the time the Consumer Products Safety Commission released a 1996 report on the fire hazard posed by the hot halogen bulbs, the RLO was ready to institute a ban.

In 1992, Residential Life asked students to rate the quality of several types of lighting installed in four rooms of a residence hall slated for renovation. After also considering the life-cycle costs of the various energy-efficient fixtures, RLO began replacing the circlelines with T-12 fluorescent fixtures, making them a standard part of subsequent building renovations.

Each summer between 1993 and 1996, RLO renovated three to five buildings with T-12 fluorescents. With a 3-year loan from the College, RLO launched a subsequent drive to replace fixtures in the remaining 1,800 rooms with the even more efficient T-8 fluorescent lamps over the spring and summer of 1997.

Only when renovations were near completion and students satisfied with lighting levels, did RLO institute a ban on halogen torchieres. By that point, student use of the torchieres had already diminished. To make it easy for students to find efficient supplemental lighting, RLO established a relationship with a local hardware store which now supplies several different varieties of compact fluorescent lighting. They also distributed letters to incoming students encouraging them to check room lighting levels before bringing lamps from home and to rely on task lamps with compact fluorescent lights for any additional lighting. For those insisting on torchieres, RLO recommended the models using compact fluorescent (CFL) bulbs that draw a modest 32 watts.

As other campuses across the country also ban halogen torchieres, says Woody Eckels, Director of Residential Life Operations, they are finding that it's crucial to work with the students and employees in finding acceptable alternatives. "Where they don't," he says, "there is often a backlash."

By replacing 1,200 torchieres with vastly safer and more efficient lighting, Residential Life anticipates savings of \$75,000 annually, enabling RLO to pay off its loan from the College within 3 years. As an unexpected bonus, the College has agreed to let RLO keep all savings accrued after the loan is repaid, enabling the department to invest in additional conservation projects.

They also distributed letters to incoming students encouraging them to check room lighting levels before bringing lamps from home and to rely on task lamps with compact fluorescent lights for any additional lighting

Light Fixture Replacement to Suit Student Needs

Cost Savings

Number of fixtures	Halogen torchieres eliminated	Total project cost	Payback period	Annual cost savings
1,800	1,200	\$180,000	3 years	\$75,000*

*Estimated savings based on an average of 7 hours daily usage of the 1,800 T-8 lights @64 watts instead of the 1,200 halogen torchieres @400 watts. Savings will likely be offset somewhat by small personal task lights brought in by students.

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Laboratory Renovations and More

Brown University

Although lighting is often a good starting point for conservation, whole buildings can be analyzed from top to bottom to identify multiple energy efficiency opportunities. Beginning in 1991 at Brown University, the 119,073-square-foot Geo-Chemistry lab went under the energy-saving microscope. The analytical work was coordinated by plant operations staff who looked for inefficiencies in mechanical systems, building shell and windows.

Over the years, classes and student interns have been involved in the analysis as well. In 1992, for example, Environmental Coordinator, Kurt Teichert supervised an undergraduate class project in which students focused on limiting fume-hood air loss and recommended a number of energy conservation measures.

While surveying the building, the students often walked into labs where the lights were on and the fume hoods were wide open with no one in sight. To address these problems, they recommended a number of "low tech" behavioral changes for building users to help control the loss of heated or

cooled air from lab areas. Reminders to close unused fume hoods and to turn off unneeded lights in labs, classrooms and offices helped to reduce the overall energy demand for the building.

In addition to these behavioral changes, the energy analysis called for the use of energy-efficient motors and light fixtures throughout the building. Reviews of energy usage before and after both light fixture and motor installations showed a reduction in electrical demand for each project of approximately 33 percent. Building envelope problems, such as water and air intrusion, were corrected as well.

More recently more than 100 occupancy sensors were installed in labs, offices and hallways, and several HVAC modifications are currently underway. Zone-presence sensors and variable air-volume (VAV) Phoenix hood controls are being installed on all fume hoods. The zone sensors reduce air flow when no researcher is detected in front of the hood. The VAV system automatically adjusts air volumes according to the number of hoods in active use. Energy use will be reduced even further when heat exchangers and super-efficient motors are added to the air-handling system.

Geo-Chemistry Lighting Upgrade

Conservation Indicators

	<u>Pre-retrofit</u>	<u>Post-retrofit</u>	<u>Savings</u>
Annual consumption (kWh)	598,000	418,600	179,400
Carbon dioxide emissions (pounds)	283,452	198,416	85,036
Sulfur dioxide emissions (pounds)	6,937	4,856	2,081
Nitrous oxide emissions (pounds)	3,110	2,117	933

Cost Savings

Annual electrical cost	Annual electrical cost	Annual cost savings \$15,500*
<u>Pre-retrofit</u> \$51,393	<u>Post-retrofit</u> \$35,856	
<u>Total project costs</u> \$79,632	<u>Utility rebate</u> \$30,260	<u>Payback period</u> 3.06 years

*This figure is for fixture replacement only. The combined savings for all projects at the Geo-Chem building is considerably higher but detailed data are unavailable.

Student research and follow-up studies have been vital to the success of many projects at Brown. According to Teichert, work with students is most productive when projects deal with "things they can see, like light fixtures and fume hoods," but it is often the invisible workings of a building that yield the largest cost-avoidance. Computer control systems, motor replacements and other HVAC energy conservation measures frequently net large savings, but they cannot be readily seen by building occupants. And good working relationships among campus facilities personnel, building coordinators, professors and students are always critical to the ongoing process of saving energy.

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Solar Panels Generating Savings

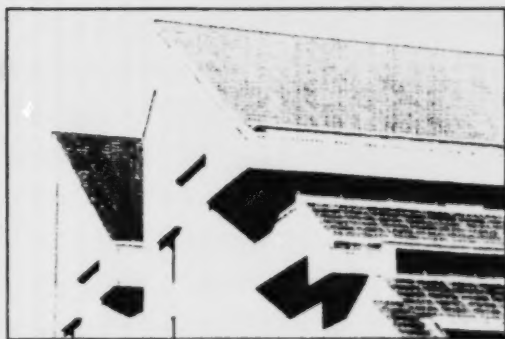
Georgetown University

Photovoltaic (PV) panels cover the south-facing roof surfaces of Georgetown University's seven-story Intercultural Center. Since their installation in 1984, the panels have produced approximately 300,000 kilowatt hours of energy. On a warm, sunny day during peak output in early afternoon, the panels supply about 30 percent of the electricity for the 215,000-square-foot building. Over the course of a year, they generate about 10 percent of the building's total electrical needs.

The original bill for the PV installation — \$10 million — was paid for by the U.S. Environmental Protection Agency and the Department of Energy as a demonstration project. At the time, photovoltaic capacity cost around \$20 per watt to install, which was vastly more expensive than conventional

electricity. Although still relatively expensive — about \$5 per watt on average — photovoltaic panels are slowly becoming more affordable. If grants or subsidies can be secured to cover the initial

capital investment costs for PV projects, the energy produced thereafter is virtually free.



Georgetown University

During the first decade of operation, accumulation of grime and mechanical failures gradually reduced the electrical output of the panels by about one-third. After a \$15,000 cleaning in 1993, output levels rebounded but failed to reach their original levels. The panels still produce substantial amounts of power, however, and even at reduced operating capacity the current annual savings are estimated at around \$45,000 a year. Electrical generation is, of course, highest in summer when utility peak-demand charges are in effect; thus, savings from the project are likewise highest during the summer months.

According to Jon Miller, Recycling and Solid Waste Manager, the 3,318-square-meter PV grid works quite well and generally runs trouble-free. Such panels are a rarity on college campuses overall and particularly in downtown Washington, D.C. Their longevity and steady performance, however, has drawn the attention of energy researchers worldwide.

When asked whether Georgetown students know much about the PV array, however, Miller comments regretfully that "it goes unnoticed." Prompted by the query for information for this report, he now plans to display a model of the building and post energy-savings information on the entry level of the building.

Photovoltaic Panels on the Georgetown Intercultural Center

Cost Savings

Annual generation of
kilowatt hours
250,000-300,000 kWh

Annual
cost savings
\$45,000

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The High Cost of Inaction

Low in profile but high in impact, exit signs can be a surprising source of energy usage and expense. Students at Brown University in Providence, Rhode Island, discovered that fact in 1987 when they conducted a complete inventory of exit signs across campus. Because the signs were illuminated 24 hours a day, it was easy to calculate the annual use of electricity once the wattage of the bulbs was known. There can be thousands of exit signs at a large university, with a surprisingly high total annual electrical demand. At Brown, the old-fashioned incandescent bulb signs burned out often, requiring new bulbs and considerable staff time for maintenance as well.

At the end of the study, students recommended replacing all high-watt, short-life incandescent bulbs with low-watt, long-life fluorescent bulbs. At the time, the project would have cost around \$60,000. Despite a detailed presentation of the clear savings over the long run, the scheme fell upon deaf ears.

Four years later, with the intervention of the new "Brown Is Green" conservation initiative, the physical plant began the changeover to energy efficient bulbs. Had the exit signs been changed when the students first made their recommendations, the project would have saved the University an estimated \$300,000 in energy and maintenance costs. The project would have more than paid for itself in its first year.



3. WATER CONSERVATION

On a planet composed two-thirds of water, it may be difficult to contemplate the prospect of water scarcity and water crises. But as many know first hand, only an estimated one percent of that water is potable, and clean water for drinking, recreation, agriculture, industry and wildlife is not always available when and where it is needed. The pressures on local water supplies grow as more and more people rely on water sources increasingly threatened by pollution.

With many communities across the country experiencing the stresses of declining water supplies, the environmental rationale for water conservation becomes obvious and compelling. Thus, it is not surprising to find that colleges and universities in water-limited areas are no strangers to conservation programs.

Many of those colleges that have cut their water usage help to free up water to maintain fish and wildlife populations in dry periods, to sustain water-based recreation, to nourish crops and livestock and to otherwise serve the needs of people and businesses dependent upon a limited resource. Their cutbacks in water usage frequently contribute to downstream pollution reduction, and, as the stories in this section illustrate, college water conservation projects can translate into budget control as well.

Most colleges and universities use large volumes of water, and they often pay for that water several times over. On one end, they bear the costs of collecting, purifying and delivering the water — whether they perform those tasks themselves or simply purchase water from a public or private utility. On the other end, colleges pay the costs related to wastewater cleanup, again whether they carry out those tasks themselves or pay a sewerage fee on the volume of water flushed and drained away. In between, there may be costs related to heating or cooling water as well. And, as the story of Brown University's showerheads illustrates, those costs can be substantial.

There may be heavy, and frequently unnecessary, use of water on some campuses — despite regional scarcities. Certain refrigeration devices and air conditioning units use once-through water flow — usually pure, potable water — to achieve cooling. Inefficient sprinkler and irrigation systems may be used in the heat of the day to sustain large acreages of thirsty turf. Decorative fountains often use drinkable water in a once-through supply system.

In many cases, such practices constitute the norm, and for water-saving projects with high up-front costs, particularly where water is cheap, there may be initial resistance to water conservation programs. Nonetheless, many schools have managed to reap substantial savings and benefit the local environment by cutting water use.



Plotting the Chesapeake Bay watershed.

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New Toilets and Water Fixtures

Columbia University

At one time, Columbia University was spending up to a million dollars a year on water, according to Lindsay Audin, former Columbia energy manager. Today that enormous bill has been cut by approximately 25 percent, and the University has saved more than 59 million gallons of water, thanks to one of the largest water conservation upgrades ever attempted at a university. The 1996 upgrades focused on domestic water, including toilets, showerheads and faucet aerators.

An energy services firm, EUA Cogenex, was contracted to do the work, and Director of Project Development, Manny Patino oversaw the project. The first step in the effort involved extensive analyses by plumbing engineers to study water pressures and vents and to determine how much

water was being used, by whom and when. Each of Columbia's 49 buildings was included in the retrofit project, although only 7 buildings representing 4 building types were closely monitored (residence halls with and without dining facilities, classroom/office buildings and laboratories). The sample buildings were metered for water use before and after the changeover.

Cost savings estimates and paybacks were calculated in painstaking detail. This was necessary to allow accurate documentation of savings once the changeover was complete. Old toilets that used 3.7 to 5.3 gallons per flush were replaced with units that consume only 2 gallons per flush. Original showerheads used 4.2 gallons per minute; new fixtures use only 2.6. Faucet aerator retrofits yielded some savings but were not considered a major part of the overall reduction.

<u>Number of Fixtures Replaced</u>		<u>Old Fixtures</u>	<u>New Fixtures</u>
Toilets	1,450	3.7-5.3 gallons/flush	2.0 gallons/flush
Showerheads	1,200	4.2 gallons/minute	2.6 gallons/minute
Faucet Aerators	4,000	not measured	not measured

The water conservation project was undertaken by Columbia because of the significant savings and the very short payback period. Even with the cost of hiring an outside firm to design and implement all aspects of the work, the payback for this project was a mere 1.8 years. This figure takes into account per-unit rebates paid by New York City, but even

without the rebates, Patino calculates a fully-loaded payback of only 2.6 years. Because of its annual savings of \$235,000, the project was regarded as a "cash cow" that helped finance energy conservation projects with payback periods longer than 3 years. Audin notes that this was a way to get energy work done by conserving water.

Replacement of Toilets, Showerheads and Faucet Aerators

Cost Savings

Total project cost	Water cost reduction	City rebate	Payback period
\$626,000	25-30%	\$203,000	1.8 years

**Annual
cost savings
\$235,000**

Conservation Indicators

Percentage Water Reduction	Water Savings
25-30%	80,000 hcf (hundred cubic feet)

Another project, completed in 1997, saves considerable amounts of water in the pipeline delivery system. A new "domestic water loop" installed between campus buildings will allow water use to be more accurately monitored and controlled. Connections to City water mains were reduced from 19 to 8, and 13 water pumps were either eliminated or downsized. These changes reduced over-pressurization in the campus system and ultimately reduced water usage significantly. Electricity savings for the pumps alone add up to tens of thousands of dollars a year, according to Physical Plant Director, Tony Trocchia.

Vast amounts of "once-through" water had been used to operate cooling devices in laboratories, kitchens and other facilities. Additional water savings have been achieved, notes Trocchia, by disconnecting some of these cooling devices from the domestic water system and connecting them to a campus chilled

water loop. Rather than flushing cool water into devices that "shed heat" and warm the water, the loop system saves on water and cooling expenses by cycling water through a cooler and recirculating cooled water back through each of the cooling devices. This was made possible when the chilled water system was converted to year-round operation in 1995. A program is in place at Columbia to convert as many of these once-through systems as possible during general space renovations.

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*The University has saved
more than 59 million
gallons of water, thanks to
one of the largest water
conservation upgrades ever
attempted at a university.*

Cleaning Up with Water-Saving Showerheads

Brown University

The replacement of the showerheads in Brown University's residence halls is a typical example of the relatively easy-to-come-by cost savings that are possible on most campuses. These are what Environmental Coordinator, Kurt Teichert calls the "old mainstays" of retrofit programs. Such straightforward "screw-in replacements" like showerheads, exit signs and lights can yield quick savings. But as this "low-hanging fruit" is harvested on a campus, more complex projects become attractive next steps for conservation.

Replacement projects have provided many opportunities for student involvement at Brown. In 1992, students in Environmental Studies conducted the initial research: They counted showerheads, timed the average length of student showers, researched and tested alternative fixtures, and calculated cost savings. Their findings led to the replacement of 750 showerheads in campus residence halls, cutting per-minute water use from 3.5 to 1.5 gallons.

The showerhead replacements reduced annual water consumption by over 12 million gallons.

Students in a later class did a follow-up study and found that water and energy savings attributable to the retrofit were even better than predicted. When student researchers clocked student showers with the new showerheads, they found them to be only slightly longer than those timed with the water-wasting showerheads. Contrary to original expectations, use of the low-flow showerheads did not promote substantially longer showering time.

In addition, water and sewer costs have risen in the Providence area since the project was completed, and those increased prices have meant increased savings. In fact, the payback was so rapid, muses Teichert, that "the project seemed to pay

for itself before we got started." Overall the showerhead replacements reduced annual water consumption by over 12 million gallons and saved the University more than \$25,000 in water heating costs, \$14,000 in sewer fees and \$5,000 in water costs.

Water Savings in University Showers

Water Detail

	Before <u>retrofit</u>	After <u>retrofit</u>
Gallons/minute	3.5	1.5
Avg. minutes/shower	9	10.6
Gallons/shower	31.5	
Showers/year	210	210
# Students affected	3,849	3,849
Gallons used/year	25,461,135	12,851,811
Total water savings/year		12,609,324

Cost Detail

# fixtures	750
Est. labor time/fixture	.5 hrs
Labor cost/hour	\$22.
Fixture cost	\$3.
Total estimated installation cost	\$10,500
Mgmt/contingency as specified in contract	\$2,100
Actual Project Cost Total	\$11,368

Cost Savings

Water purchase <u>savings/year</u>	Sewer <u>savings/year</u>	Water heating <u>savings/year</u>	Payback <u>period</u>	Total annual <u>cost savings</u>
\$5,450	\$14,885	\$25,465	4 months	\$45,800

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Xeriscape Landscaping Saves Water at an Urban Desert Campus

Mesa Community College

Xeriscape — not a term that rolls off the tongue, but an approach to landscaping that made sense to Mesa Community College's (MCC) Director of Buildings and Grounds, Rudy Mendez, when he was told that the Arizona campus needed to cut its water use. With financial help from the City of Mesa and the Salt River Project — a local water utility — Mendez initiated a project to demonstrate xeriscaping, a landscaping strategy that relies on plants that require little water.

Working with biology professor Ron Dinchak and retired soil scientist Jim Claridge, Mendez designed a series of plantings for the 1.5-acre area around the newly erected Social Cultural Science building. Their aim was to highlight the variety of drought-tolerant plants that can thrive in Mesa's climate, including native desert plants and arid-lands plants from around the world. The award-winning garden offers an eye-catching complement to the turf areas, rose garden and conventional landscaping and has proven to be a popular campus attraction. It features native Sonoran desert species including barrel cactus, ocotillo and yucca and trees such as palo verde and mesquite as well as Mediterranean flowering shrubs and trees, 15 species of Australian eucalyptus trees and desert-adapted turfgrass.



Xeriscaping is being introduced into several other areas on the Mesa campus, including entrances to the College grounds and along parts of the periphery. All are drip-irrigated during dry weather. As individual plants become established, they survive on natural rainfall of around eight inches a year. At the Social Cultural Building garden, roughly 30 percent of the plants no longer need irrigation. Compared to other parts of campus, the garden's water costs have been extremely low, since xeriscape plants use up to 90 percent less water than traditional landscape plants. Exact savings for this project are unknown, because water used for landscaping is not metered for individual parts of the campus.

The future of xeriscape and water conservation looks most promising at MCC's new east campus. Set for development in what is now 100 acres of natural Sonoran desert, the new campus will remain primarily a desert ecosystem. Noting a 180-degree shift in local thinking over the last 10 years, Mendez remarks that "Everybody wants to keep the saguaros [cactus] and to conserve the natural surroundings." Reflecting on his experience at MCC's main campus, he adds, "We've done the learning here, and now we're going to apply it over there."

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4. DINING SERVICES

Along with a diverse menu of knowledge and ideas, most colleges and universities serve up a lot of food. Campus-based dining services are a major business, especially on large campuses where thousands of students spend their work and recreation hours. Unlike resource conservation efforts in boiler rooms or other places students seldom see, initiatives launched in school cafeterias can be visible to all, resulting in an educational impact along with environmental benefits.

Environmentally-motivated changes in dining services tend to fall into three categories:

- 1) Replacing disposable items such as cups, trays, plates and flatware with long-lasting washable items;
- 2) Reducing dining services waste destined for the landfill by instituting recycling and composting; and
- 3) Providing locally-grown or organic foods.

Campuses that remain in charge of their own dining services (the "self-ops") are often able to make these changes, whereas those that contract the service to private firms typically have less say in the matter.

While many of the food-related switches that campuses have undertaken to promote sustainable agriculture can entail increased costs, the campuses featured in this section have achieved cost savings by

Initiatives launched in school cafeterias can be visible to all, resulting in an educational impact along with environmental benefits.

substituting durable serving-ware and refillable mugs for disposables. Further on in this report are examples of dining services cost savings achieved through recycling and composting.



Bates College

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Washable Cups in the Freshman Union

Harvard University

Prior to 1992, Harvard University's freshman union dining hall used washable flatware, plates, bowls and trays. But unlike other undergraduate cafeterias on campus, which all used "durable" mugs and cups, the freshman union was using paper cups for hot and cold beverages. To serve Harvard's 1,650 freshmen, the union was purchasing and landfilling more than 5 million paper cups each year. The use of so many cups was becoming increasingly expensive, recalls Dining Services Project Manager, Alexandra McNitt, and a pilot project to replace disposable cups with durable ones was initiated.

Soon after an initial purchase of eight-ounce glass tumblers and melamine plastic mugs, campus staff realized that students were filling anywhere from four to six cold-drink glasses per meal, far more than had been anticipated. In response to this discovery, the glass tumblers were replaced with 12-ounce plastic tumblers which were less

expensive and had a longer life. Students tended to need only two or three of the larger plastic cups per meal. A cost analysis showed that the program resulted in significant savings: Only one-fifteenth as many paper cups were needed. Despite the added costs for replacing lost cups (around half are replaced annually), the savings from avoided pickup and disposal of discarded paper cups made the overall effort worth continuing.

Although no new cost-benefit analysis has been made since 1992, Dining Services continues to use the washable cups in the freshman facility. McNitt affirms that the original savings estimates still apply. Increased water costs have been offset by increased costs for paper cups and landfill space.

A significant number of paper cups are still used, because they are needed for take-out beverages at the freshman union. Students, however, are encouraged to use the plastic cups and consume their beverages on the premises. Each year, 12,000 tumblers and 4,300 mugs are purchased to replace missing items, so further savings could be achieved if students would always return "borrowed" cups and mugs.

Washable Beverage Cups Replace Disposable Paper Cups

Cost Savings

	Annual average <u>before 1991</u>	Annual average <u>1991 to present</u>
Number of paper cups needed annually	5.4 million	350,000
Cost of paper cups each year	\$191,000	\$12,000
Annual cost of replacing durable cups	—	\$6,000
Estimated cost of pickup and disposal of paper cups	\$15,000	\$1,500
Annual total cost	\$206,000	\$19,500
Annual cost savings		\$186,500

Former Environmental Resources Chair for the National Association of College and University Food Services, McNitt observes that campuses in areas where water is scarce and expensive sometimes find it cheaper to landfill disposable food and beverage containers than to wash them. On the other hand, a 1991 cradle-to-grave analysis comparing foam to plastic tumblers conducted for the Portland Board of Education concluded that manufacturing and washing plastic food and beverage containers ultimately produces fewer pollutants and uses less energy than does producing and disposing of foam containers.

With the waste reduction issue, as with any conservation project, staff and students have recognized that it is important to evaluate and balance cost savings and environmental impacts when making product selections and to realize that the most cost-effective and environmentally sensible choice may vary from place to place.

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Saving on Refillable "Red Mugs"

University of Wisconsin

It's a constant question in campus conservation circles: "Do people really use their reusable mugs?" The University of Wisconsin-Madison was one of the first campuses to initiate a refillable mug program and one of the few campuses to test mug usage.

The University of Wisconsin has the earliest known documentation for sale and use of plastic mugs that earn refill discounts at campus dining facilities. In 1984 several hundred mugs were produced thanks to a loan from environmental studies professor Cal DeWitt to the Environmental Studies Student Association (ESSA). This first batch of mugs promptly sold out and several more batches were produced until ESSA lost momentum as an organization.

Starting in November 1989, the Wisconsin Union launched its own "red mug" program, offering discounts for coffee and tea sold in 12-ounce insulated plastic mugs. Mugs sold briskly and were a common sight in union cafeterias and dangling from student backpacks. Special buttons on each cash register were used to track sales, and the resulting records indicate that red mugs accounted for approximately one out of every three coffee purchases in the first years of the program.

Yielding to patron pressure and cup-saving economics, the Union agreed in 1990 to apply its discount to any mug of comparable size. In addition, cold beverages like milk, juice and soda were given discounted prices if patrons used their own mugs. In 1993, a 32-ounce refillable insulated beer stein was also introduced, but its acceptance and use has been modest.

The Union sold 72,000 red mugs of essentially the same size, color and design between November 1989 and June 1997. Sale and use of the mugs slowed gradually, however, dropping from an estimated high of 8,000 uses per week in 1993 to around 2,675 per week during the 1996-97 school year.

When a mug is used to buy a beverage, the Union saves 2.4 cents on a paper cold cup and 15 cents on a foam hot cup. Custodial staff also empty the trash bins less often, and disposal tonnages are slightly reduced. Eventually the number of uses of the mug and its associated discount catch up with the landfill and maintenance savings and the 95 cents profit for each mug sale, however. At that point, the Union begins to lose money on those mugs that are refilled repeatedly. This may be why some campuses give away mugs as an incentive for waste reduction but offer no discounts, while others offer discounts on par with avoided costs for disposables.

Sales of Refillable Red Mugs

Revenues

Average sold per year*	Sales profit per mug	Annual revenue from mug sales
9,000	.95	\$8,550

*During the years 1994-1997, with a purchase price of \$2.00.

Cost Savings

Beverages purchased in refillable mugs	Cost of 1,000 foam hot cups	Cost of 1,000 paper cold cups	Annual cost savings	Total annual savings/revenue
116,700*	\$24	\$45	\$2,875**	\$11,400

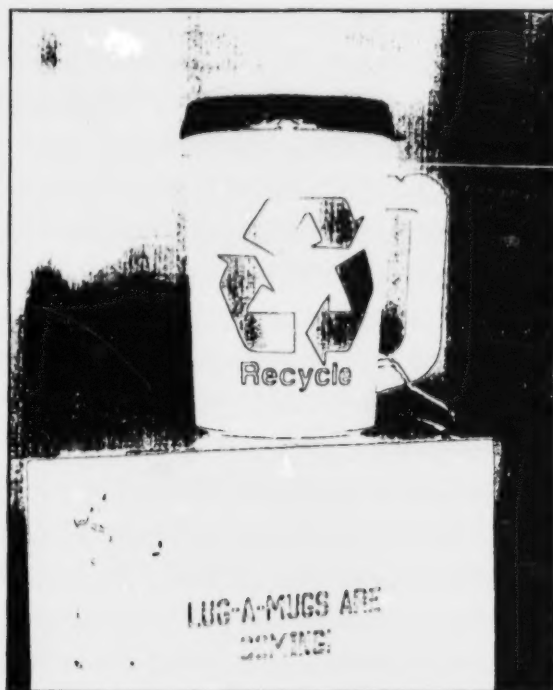
*113,625 hot beverages (coffee, tea, chocolate), 3,075 cold beverage (soda, milk, juice).

** Data for 1996-97 school year.

The decline in red mug usage prompted Dining Services Director, Julie Vincent and her staff to introduce a new mug in the fall of 1997. The University hopes that the new promotion will rejuvenate sales and that a periodic change in mug design will keep interest high. These changes may result in a steadier sales volume for the mugs, notes Vincent, and, in addition, the campaign will let them have a little fun in marketing the mug idea.

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Standard School Equipment — the Take-Out Tray

Bowling Green State University

Prior to the mid-1990s, when Bowling Green State University (BGSU) students wanted to eat meals in their rooms or outdoors, they loaded paperboard take-out trays and headed out the door. After one use a tray was tossed, and in a year's time BGSU's 6,000 residents trashed tens of thousands of trays. This wasteful practice came to a halt when former Dining Director Jane Schimpf ordered durable trays made of fiberglass and gave one to each incoming resident. The durable trays, which were printed with the school logo, were theirs to keep. And the paper trays were available no more.

Because records of past paper tray purchases are archived, no documentation is available for cost comparison. The current Associate Director of Dining Services, Nancy Joseph, however, says that the savings attributed to the switch "were substantial." The University saved thousands of dollars in purchase costs alone, not to mention the lighter load in trash cans and dumpsters. Joseph notes that the program is also popular with the students. Most of them take their 13-by-13-inch trays home with them at the end of the year. Some, however, are left behind to be used by the next year's crop of students.

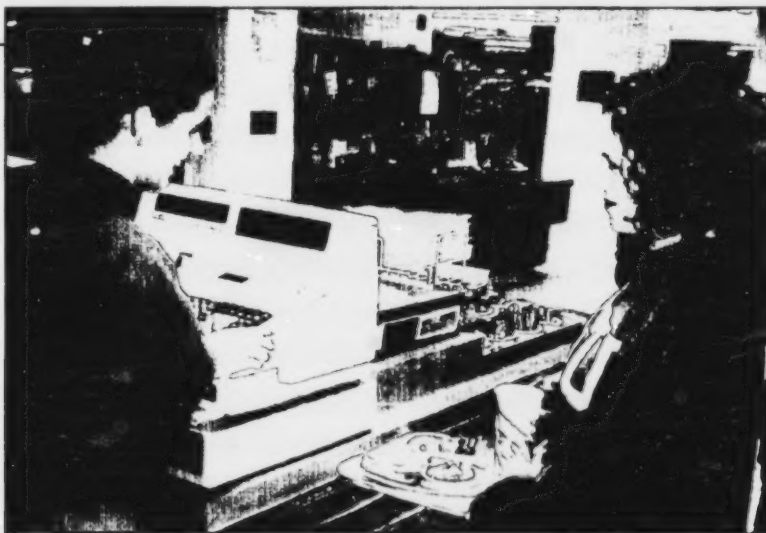
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5. RE-USE

Given a boost from widespread interest in recycling, the practice of re-use is becoming more common on campuses. While recycling typically takes a waste material and converts it back to raw materials, re-use is the process of finding new uses for or redistributing items that would otherwise be discarded or stored indefinitely.

For instance, some campuses save foam packing "peanuts" that arrive inside boxes and use them again for packing up new shipments. Others use cardboard boxes, inter-departmental mail envelopes, printer toner cartridges and other items repeatedly until they finally wear out. Some pile up excess wooden shipping pallets in an area where the public can come and take them. And campus departments sometimes have a "free shelf" for extra office supplies, lab equipment, books, magazines and even surplus home vegetables. "Closing the loop" or recycling materials such as paper and motor oil and then purchasing those same products in recycled form is, in essence, another form of re-use taking place on college campuses.

The following examples illustrate how campus re-use programs can save money on specific products (lab chemicals and motor oil) as well as on a wide variety of campus durable goods (surplus properties). Recirculating goods in-house has been going on for a long time, but colleges and universities are now exploring even more creative ways to find new uses for campus property.



Sale of Surplus Property

University of Wisconsin

Many students wonder if it is possible to turn their passion for environmental stewardship issues on campus into a full-time job. The University of Wisconsin-Madison (UW) has shown that it can be done. What started as an experiment in salvaging usable goods from the University's waste stream ended up as a full-time, high-profile job for Neil Peters-Michaud, a UW alumnus. In 1994, after working for a year as the Midwest Campus Ecology Coordinator for the National Wildlife Federation, Peters-Michaud launched the Solid Waste Alternatives Project (SWAP), working with the University's Environmental Management Program and Physical Plant and funded by a grant from the Wisconsin Department of Natural Resources.

Peters-Michaud set up systems to capture a wide variety of goods and materials that were perceived by UW's Surplus Department to have no value. Those items typically ended up in the scrap-metal heap or the landfill. An innovative Internet-based inventory and ordering strategy plus active brokering of used materials to charities and an increase in sales frequencies brought the project great success in its first two years. In response to that success, UW combined SWAP with its existing surplus operation and in 1996 hired Peters-Michaud to run the new hybrid.

With a crew of six and a truck, SWAP/Surplus diverted approximately 1,000 tons of materials from the waste stream in fiscal year 1996-97, including many items from offices and labs that would have been sold for scrap. Over the year, Program Manager, Peters-Michaud developed a new position just to prepare surplus computers for sale. The technician's \$26,000 salary was easily offset by the increase in sales revenue of \$57,000. Currently, computer sales account for around 40 percent of total SWAP income.

In addition, Peters-Michaud expanded the existing Offers-to-Sell (OTS) program that earns

SWAP a commission for selling surplus University department equipment through a blind-auction-type process. Departments wishing to sell their equipment through this program submit a list of prospective buyers and specifications for the item in a bid format to SWAP. Information about high-value items available for sale gets to the right people, and items sell quickly through intensive use of the Internet to market offerings. Photos of common items such as desks, chairs, telephones and computers, as well as one-of-a-kind pieces of lab equipment, are featured on SWAP's Web page and shoppers can place offers on line. The program was budgeted for \$600 in revenues but actually earned \$128,000 over the year. There are a few programs like this on other campuses, says Tim Sell, current manager of the program, "but the OTS and use of the Web have made ours especially successful."

An ongoing effort to provide community groups and non-profit organizations with

affordable office furniture and supplies has also brought the program much publicity. And aside from a few rough spots, including a high turnover of staff, glitches in the computer inventory system, shortage of space and a complicated budget, SWAP has been an environmental and money-saving success. It has had considerable public relations value for the University and has

reduced purchase costs of equipment. According to Peters-Michaud, SWAP's most noteworthy achievement is its financial self-sufficiency.

With a crew of six and a truck, SWAP/Surplus diverted approximately 1,000 tons of materials from the waste stream in fiscal year 1996-97.

SWAP/Surplus Program Summary

Cost Savings

<u>Net revenue from sales & commissions</u>	<u>Operating expenses</u>	<u>Net retained income</u>	<u>Avoided landfill fees</u>	<u>Credits to departments for sales of goods</u>
\$299,000	\$264,800	\$34,200	\$21,600*	\$186,000**

Retained earnings	\$34,200
Avoided landfill tipping fees	\$21,600
<u>Credits to departments</u>	<u>\$186,000</u>

Total annual savings/revenue \$241,800

* Based on an estimated weight of 600 tons diverted from the landfill at \$36/ton.

** This is money returned to campus departments as commissions for sales of goods such as computers, lab equipment and audio/visual materials.

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Campus Information: (608) 262-1234



Neil Peters-Michaud, UW-Madison

Maintaining Vehicles with Re-Refined Motor Oil

University of Illinois

Since 1990, all fleet vehicles at the University of Illinois, Urbana-Champaign (UI) have been maintained with re-refined motor oil — oil made from reprocessed waste oil. Used oil from UI vehicles is re-refined by a company in Chicago that cleans the oil and replaces all the important additives. Currently, one company buys the University's used oil for re-refining, and another provides re-refined oil to the University.

A carefully conducted study coordinated in 1989 by Carpool Supervisor, Jim Trail showed that re-refined oil actually performs better than premium and name-brand motor oils. This was surprising but welcome news for the Transportation Department staff responsible for upkeep of the University's 280 carpool vehicles, 1,100 trucks and cargo vehicles, and more than 500 farm, construction and other machines.

Purchased in bulk, re-refined oil is about 25 percent cheaper than virgin motor oil.

Federal Environmental Protection Agency (EPA) rules require the "proper disposal" of waste oil, and many businesses and institutions have opted for incineration or fuel-blending, which captures the oil's energy value but depletes the resource and contributes to air and water pollution. All options involve a cost, but UI has chosen to invest in the

much more sustainable practice of re-refinement which recaptures most of the lubricant value. Currently, the University pays around six cents a quart to have the waste oil hauled away and re-refined.

The use of re-refined oil made it possible for UI to close the re-use/recycling loop and, according to Transportation Manager, Mike Hari, "It's been a real money-saver for us." Purchased in bulk, re-refined oil is about 25 percent cheaper than virgin motor oil, and its use saves the University a few thousand dollars each year. In addition, by supporting the re-refinement of oil, UI is using its buying power to promote a disposal option that conserves an important natural resource.

Using Re-Refined Oil for Fleet and Engine Maintenance

Cost Savings

<u>Annual volume of re-refined oil</u>	<u>Annual cost for re-refined oil</u>	<u>Estimated cost for same volume of name-brand oil</u>	<u>Annual cost savings</u>
18,920 quarts	\$10,784*	\$14,000**	\$3,500

*Calculated at .57 per quart.

**UI does not buy name-brand oil in bulk. This cost, based on a bid price, is an estimate of what bulk name-brand oil would cost (at .75 per quart). These numbers give an approximation of the savings attributed to the purchase of re-refined oil.

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Second Time Around for Chemicals

University of Washington

According to University of Washington chemical waste disposal rules, when research laboratories have unwanted chemicals, they list them as surplus in an inventory maintained by the Environmental Health and Safety (EHS) department. If the containers are unopened or their purity can otherwise be assured, surplus chemicals are made available free of charge to other researchers on campus. In 1996, more than 1,000 pounds of

chemicals were exchanged under this program. With disposal of lab chemicals averaging around two dollars a pound, the surplus chemical exchange program saves thousands in avoided costs of disposal and new chemical purchases.

The pace of redistribution has picked up recently due to computerization of the inventory records. In fact, participation in 1996 was twice the 1995 level. Putting the information on-line "has made a tremendous difference," says Ron Claus, EHS research specialist for pollution prevention. Researchers are able to access the list of available chemicals 24 hours a day and can place orders via e-mail. The list is updated frequently.

1996 Surplus Chemical Exchanges

Cost Savings

Combined weight of <u>exchanged chemicals</u>	Avoided disposal <u>costs</u>
1,400 pounds	\$2,900*

*Reflects disposal costs only and does not include money saved by labs that did not have to purchase the new chemicals from outside sources.

The surplus chemical program is just one of a dozen pollution prevention efforts that collectively saved UW's Environmental Health and Safety department around \$79,000 in disposal costs in 1996.

Another example of re-use at the University is the recovery and refinement of waste xylene, a widely-

used laboratory solvent. In campus labs, used xylene is stored separately from other waste solvents. It is collected periodically, re-distilled on campus and then sold back to the labs, costing \$12 per gallon less than xylene from commercial sources. In addition to generating sales income, EHS avoids paying disposal fees for the waste solvent.

Xylene Refinement and Resale

Cost Savings

Volume of xylene <u>recovered</u>	Resale price <u>savings</u>	Total resale <u>savings</u>	Avoided <u>disposal cost</u>	Annual <u>cost savings</u>
580 gallons	\$12/gallon	\$7,000	\$4,500	\$11,500

Total annual savings/revenues for chemical exchanges and xylene resale \$14,400

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Campus Information: (206) 543-2100

Students Play a Central Role in Achieving Cost Savings

Students benefit from and contribute to cost-saving campus conservation programs in a variety of ways. They provide important research and analysis; assist with peer education and training; conduct community outreach; assist with program design and implementation; fundraise; and generally cooperate with and participate in conservation initiatives. Student involvement has proven beneficial not just for the college but also for the individual student, who is provided with important opportunities to apply knowledge gained in the classroom, to hone leadership skills and to develop an edge in a competitive job market. The following are just a few of the ways that students have contributed to the cost-saving conservation projects featured in this report:

- Assisting with transportation demand management program research and implementation efforts at Cornell University, UW-Madison and UC-Boulder;
- Serving as building conservation contacts at SUNY-Buffalo, making sure lights are turned off at night and building air temperatures set appropriately;
- Analyzing building lighting and water usage and recommending cost-saving improvements at Brown University;

- Using compact fluorescents instead of incandescent lights in residence hall rooms at Dartmouth College;
- Carrying and using reusable mugs and/or trays at Bowling Green State, UW-Madison, Dartmouth College and hundreds of other universities across the country;
- Starting a new materials exchange program at UW-Madison;
- Assisting with materials processing and recycling education at UC-Boulder; and
- Conducting a materials characterization study at UW-Madison.

The Intern Solution by Lynn K. Chamberlin and Kirk Conger, PE, is a particularly good source of information on how to involve students in energy and environmental surveys. This book was published in 1995 by the Nebraska Energy Office. See the resources section for ordering information and for other sources of information on student leadership and involvement in campus greening efforts.

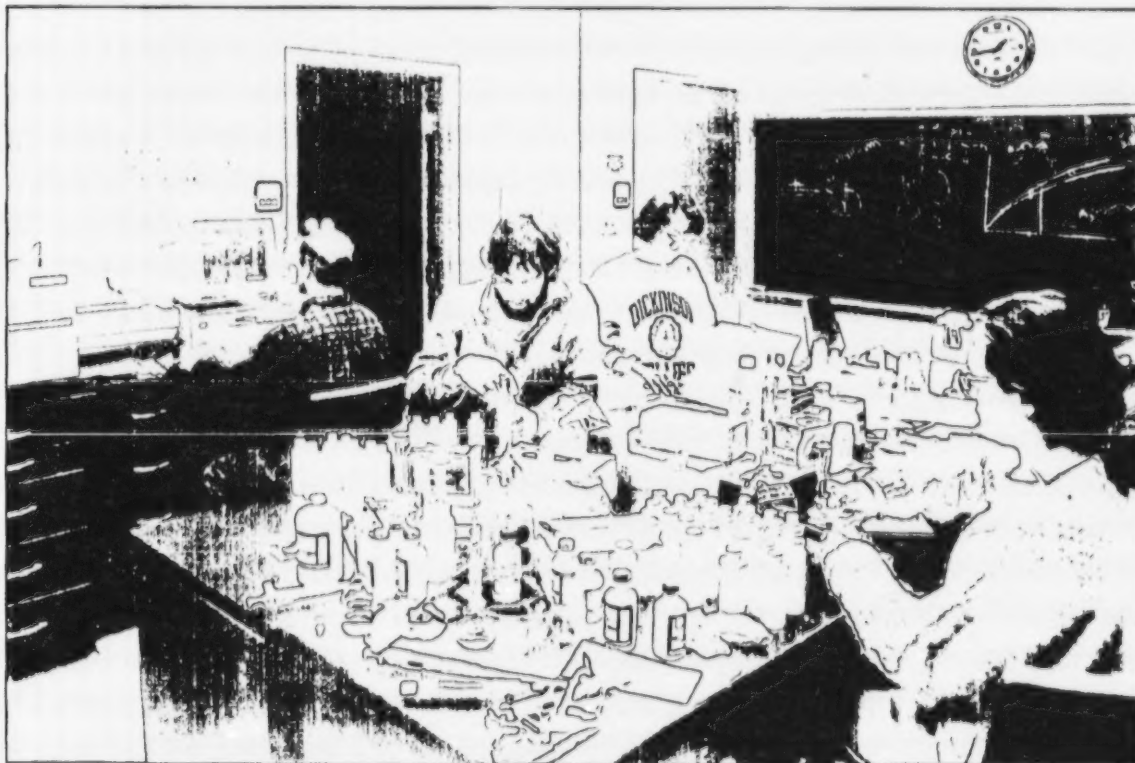


6. MANAGEMENT OF HAZARDOUS CHEMICALS

Thanks to scaled up efforts to minimize the use and disposal of hazardous waste over the last decade, colleges and universities are becoming cleaner, safer communities in which to work, study and live. Still, many types of hazardous chemical products are used and sometimes necessary for teaching and research and for the efficient operation of a college or university. Nearly all schools use certain hazardous organic and inorganic chemicals for laboratory courses, for instance, and campus facilities and maintenance activities may require the use of numerous hazardous solvents, pesticides, fuels and cleaning products.

A 1990 EPA report on pollution prevention estimates that colleges and universities generate 4,000 metric tons of a wide variety of hazardous substances each year. And a few campuses, including a couple with excellent conservation programs in place, are hosts to Superfund sites — legacies from the days when little thought was given to the environmental consequences associated with disposal of used or leftover chemicals. This short-sightedness is still apparent in many places today.

Over the years, the disposal of hazardous materials has become more stringently regulated — and expensive. To protect public health and the environment, businesses and institutions are no longer permitted to send certain unwanted chemicals to the landfill or to pour dangerous excess organic solvents down the drain. Strategies for dealing with hazardous substances and waste on campus, such as using smaller quantities, substituting less-harmful alternatives and preventing pollution from occurring in the first place, have been gaining in popularity. Examples of cost-effective efforts to reduce chemicals in laboratories and landscaping are described below.



Cutting Out the Weed Killers

Seattle University

When Grounds Manager, Ciscoe Morris took over operations at the 53-acre Seattle University in 1978, landscaping practices included applying liberal quantities of herbicides and insecticides. Shortly after his arrival, Morris began the long process of cutting back on pesticide use and developing landscaping alternatives that make chemical application largely unnecessary. His primary tools have been vegetative groundcovers. Because weed growth is the chief problem in most non-turf areas, Morris relies heavily on what he calls "weed fighter" groundcovers — aggressive, dense-growing plants that establish themselves quickly and out-compete the weeds.

The Seattle University experience shows that it takes about three years for a new landscaping project to become weed-free. These areas are maintained by hand labor during the transition time but afterwards are almost maintenance-free. Installing the right mix of groundcovers can cost thousands of dollars up front, notes Morris, but the plants pay for themselves within a year after the hand-weeding ends. Conventional plants, which are also expensive to install, tend to require weeding and other inputs throughout their lifetime. Other savings with groundcovers include reduced demand for chemical inputs, less soil loss due to erosion and lower equipment maintenance costs.

To show the long-term savings in his planting strategy, Morris analyzed the costs associated with a single 5,000-square-foot landscape bed that was maintained for many years with conventional plants. Several times each year, it required extensive weeding. In 1991, the area was replanted with rock rose, a flowering, evergreen groundcover.

*The plants pay for themselves
within a year after the hand-
weeding ends.*



Ciscoe Morris, Seattle University

Groundcover Replacing Conventional Planting

Cost Savings

Pre-1991

Annual labor costs* \$3,000

1991 Replanting

Annual labor costs for first 3 years* \$3,000

Annual labor costs thereafter \$100

Installation cost of plants \$1,400**

Annual replacement cost of plants \$0

Overall Cost Differential

Traditional plants \$30,000***

Groundcovers \$10,000

Annual cost of
pesticides, pre-1978
\$1,500

Annual cost of
pesticides, 1990s
\$200

**Annual
cost savings
\$1,300**

* Estimate for a 4-person crew, weeding 4 8-hour days at a time, 3 times annually at a rate of \$8.00 per hour.

** A one-time expense.

***Includes costs associated with replacement of conventional landscape plants in non-turf areas.

In the remaining turf areas, herbicide reduction has been the most controversial part of the evolving Integrated Pest Management (IPM) strategy. With very low levels of spraying, lawns at the University are dotted with white clover, dandelion and other common weeds. From one perspective, these add color and variety to the grass; others prefer a pristine, grass-only turf. Despite some criticism, Morris has managed to continue the effort to keep healthy, low-maintenance lawns. Not only does he use smaller amounts of pesticides, he also uses only products having relatively low toxicity. His efforts have won him the support of students and most staff, in particular those who are chemically-sensitive.

Because of its long history as a chemical-free environment and its abundant wildlife-friendly landscaping, the Seattle University campus was certified in 1989 as a Wildlife Sanctuary through the Washington State Department of Wildlife. No other college or university in the state has managed

to earn this recognition, though several have tried. The sanctuary designation has helped Morris resist plans to remove trees or otherwise alter the "balance of nature" created on campus.

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Chemistry Classes with Fewer Chemicals

University of Minnesota

The undergraduate chemistry labs at the University of Minnesota (UM) serve about 7,600 students each year and traditionally have used large quantities of solvents and chemicals for experiments. Each year, the labs generated around 10,000 liters of solid and liquid waste. Initially disposal was not an issue, but air and water quality regulations have grown tougher over the last decade and forced campuses such as UM to rethink their lab procedures.

In 1993, with help from a grant, chemistry professor Kent Mann took on the task of analyzing materials and methods used in two introductory chemistry labs. He and Lab Manager, Ted Tolass learned about "microscale" lab techniques and looked at options for using smaller quantities of chemicals as well as less harmful ones. One change, Tolass notes, was that "we got rid of a lot of the heavy metals." They also reduced the amount of hazardous waste solvents to one-percent of former volumes. Some of the redesigned experiments produced no harmful wastes at all.

Although the labs now use smaller amounts of many chemicals, professors in the chemistry department ruled out a complete conversion to microscale. Because most real-world industrial laboratories do not use microscale techniques, the elimination of all conventional-scale lab work "would be doing our students a disservice," Tolass explains. UM's approach was to develop a blend of conventional and microscale lab experiences, all of which are more environmentally sound than those used previously.

In addition to changes in the experiments, a number of behavioral changes were introduced to cut chemical use in the labs. In the past, students tended to use large beakers, filling them up with a needed solvent at the dispensing station when only small amounts were required. By providing only smaller glassware and lowering spigots on the solvent dispensers so that large containers would no longer fit under them, the labs were able to substantially reduce wastes. Other savings occurred when repetitions of some experiments were eliminated.

Reduction of Hazardous Wastes Generated by Chemistry Labs

Cost Savings

<u>Volume of waste before conversion</u>	<u>Volume of waste after conversion</u>	<u>Average disposal cost</u>	Annual cost savings \$37,000*
2,500 gallons	23 gallons	\$15/ gallon	

*The total cost of the lab conversion was \$30,000, with most expenses covered by a grant from the Minnesota Office of Waste Management. The payback for this initiative was less than one year.

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Finding the Money to Start

Recognizing that saving money often costs money to begin with, several campuses featured in this report have found creative ways to finance their conservation projects. To enhance the financial performance of existing conservation programs and to start new ones, program coordinators have employed rebates, secured grants, reinvested savings, allocated student fees, taken out loans and revised bidding and contracting processes, among other strategies. The following are just a few examples:

- Utility rebates covered a portion of the costs of retrofitting the Geo-Chemical Building at Brown University.
- A grant from the local water utility helped Mesa Community College develop its xeriscape landscaping efforts.
- Student fees help cover recycling program costs at UC-Boulder.
- A tax-free bond issue brokered through a performance contract underwritten by a major energy consulting firm finances most of Elizabethtown College's recent energy conservation projects.
- Issuing competitive "Offers to Sell" to prospective bidders for the University's surplus materials and recyclables helps UW-Madison finance its recycling and materials exchange programs.
- A grant from the State Office of Waste Management covered most of the expenses for the University of Minnesota's adaptations to microscale lab techniques.
- Dartmouth College will allow its Residential Life Operations to keep and re-invest savings from its energy retrofit projects into new conservation initiatives.



Paul Smith's College

7. COMPOSTING

A pithy bumper sticker sums up nature's recycling method of choice: "Compost Happens." The beauty of composting, adherents stress, is that it is low-tech, ecologically efficient and sustainable. Unlike a landfill, a composting facility site does not fill up but cycles materials through with little or no real "waste." By tapping into natural processes, composting projects can transform a sizable proportion of a waste stream into a useful product.

There are two primary sources of compostable organic (carbon-based) materials on college and university campuses: food and landscaping wastes. For all but the last 10 years or so, materials from those sources were treated like every other type of "trash" — hauled away. Prompted by student interest and/or state and local laws prohibiting the landfilling of yard waste, a number of campuses have come to view composting as a better means of handling these waste products.

Where land is available, some campuses simply stack weeds, brush trimmings and autumn leaves into piles and let nature take its course. With yard waste this is relatively uncontroversial. Food waste, however, is another matter. Due to concerns with odor, vermin and public health, food waste composting is much more closely controlled. Full-scale composting facilities sometimes require large initial investments, but they have proven to be an environmentally sound and cost-effective means of waste disposal.



Photo by Jaymie Mackler

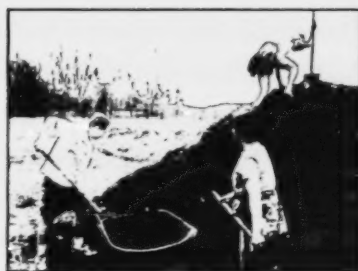
Creating Fertilizer with Kitchen Food Waste

Dartmouth College

Dartmouth College has been composting dining services food waste on the 4,000-student campus since 1990. Kitchen trimmings and scraps (pre-consumer, or pre-meal, food waste) are segregated from other wastes and hauled to the composting area. Food waste is mixed with used napkins and other scrap paper and also with cow manure

trucked in by a local farmer.

These ingredients ensure the proper proportions of carbon and nitrogen essential for complete decomposition. A College tractor is used to shape the mix into long piles or windrows and to turn them twice monthly.



The compost that is produced — about 10 tons a year — is used to fertilize the gardens and plants on campus. Over the years Dartmouth has saved thousands in avoided fertilizer and mulch costs. Furthermore, landfill tipping fees and associated trucking fees have been eliminated for every ton of waste that is composted rather than dumped.

When the program started, there were also immediate savings related to the garbage grinders in kitchen sinks, notes Bill Hochstin, Assistant Director of Facilities Operations and Maintenance. With composting, he says, "You turn off the garbage disposals and suddenly you've saved the labor needed to keep them running and stopped all the water that's constantly running through them." According to Hochstin composting has favorably affected the water, sewer, electric and facilities maintenance bills.

Windrow Composting Pilot Study

Cost Savings

Compost <u>produced</u>	Avoided purchase <u>of fertilizer</u>	Avoided landfill <u>tipping fees</u>	Program <u>expenses</u>	Project <u>cost savings</u>
20,000 pounds	\$9,700*	\$1,700	\$1,200	\$10,000**

*Based on 1990 cost for a 50-pound bag of compost at \$8.50.

**The project cost savings data cover only an 8-month period. A full year's savings would actually exceed this amount.

Dartmouth's commitment to composting will reach a new plateau in the near future. Plans are set for construction of an in-vessel composting facility on municipal land that will separately handle organic wastes from the College and sewage sludge from the City of Hanover. This for-profit private operation will market the compost it produces. A larger volume of wastes will be diverted from Dartmouth for the new facility. Post-consumer food, leaves, brush and other landscape waste will be added to the kitchen scraps already being collected, and Dartmouth's wastes will be kept separate from the City's so that its compost can be safely used on the College's organic vegetable garden.

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Composting Wastes and Scrap Wood

University of Colorado

For many years, students and staff at the University of Colorado (CU) explored the idea of composting, but an on-campus operation never appeared economically feasible. After becoming increasingly uncomfortable with sending campus landscape wastes to the landfill, Grounds Supervisor, Alan Nelson looked for a commercial alternative. In 1996 he located A-1 Organics, a private composting facility 30 miles away in Golden, Colorado. The company handles wooden pallets and wood waste, plus brush, sod and other landscaping debris. Materials are chipped in A-1's tub grinder, mixed with brewery waste and other materials, and set out in windrows to be composted.

The tipping fee at A-1 is comparable to the tipping fee at the landfill, and the hauling distance is only one mile farther, so the decision to have organic wastes composted instead of landfilled was not made strictly on economic terms. "It's a karma thing," jokes Nelson, who

asserts that composting is the right thing to do with organic wastes. There is, conveniently, also a small financial incentive. As a client of A-1, Nelson is able to buy back finished compost at a discount. The cost of the compost — made in part from CU's own waste — is 50 percent less than the cost of the soil amendments that the University had been buying previously.

When campus materials are delivered to A-1 they are accounted for by the cubic yard. Chipped brush is the largest category, with around 900 cubic yards delivered each year. Annual volumes of other materials include wooden pallets (90 cubic yards), wood waste (55 cubic yards), leaves (35 cubic yards), sod (12 cubic yards) and stumps (8 cubic yards). Nelson hopes to find interested students to help him keep track of the exact quantities

collected and the fees paid. Although organic materials make up only a modest portion of the total waste stream, having that waste composted rather than landfilled is an important campus milestone.



Black Cow Photo

Compost Volumes and Purchases

Cost Savings

Volume of organic waste composted	Amount of A-1 compost purchased	Commercial compost cost	A-1's compost cost	Annual cost savings
1100 cubic yards	100 cubic yards	\$26/cubic yard	\$13/cubic yard	\$1,300

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8. RECYCLING

At most colleges and universities, at least some part of the institution's waste stream is intercepted before it ends up in a landfill or an incinerator. While some schools recycle only aluminum cans or cardboard, others have cut waste by 50 percent and more with comprehensive, multi-material recycling programs. The economics of recycling often figures heavily into what does and doesn't become trash. These numbers, which can be complicated to sort out, include container costs, staff time, hauling costs, tipping fees, avoided landfill or incineration costs, revenue for materials, load contamination costs, contracting provisions, market fluctuations and so on.

In some places and in some years, recycling has paid reasonably well. In the populated east, recycling companies can offer attractive contracts with guarantees that assure prices paid for recyclable goods will not drop below a specified "floor." In the spring of 1995, for example, the market for recycled paper was off the charts and revenue returns were high. In other places, such as western states where land is relatively cheap and recycling markets may be hundreds of miles away, landfills often remain the disposal method of economic choice.

And in a somewhat ironic twist, the popularity of recycling has led, in recent years, to a nationwide flood of recyclables on the market that has generally driven materials prices downward, with the exception of a few commodities such as aluminum.

There are two primary opportunities to save or make money in recycling: 1) avoiding the cost of conventional disposal and 2) generating revenue for recyclables. With luck — and smart contracting — these opportunities can combine to make recycling cost-effective and sometimes even profitable.

In addition to economic and environmental benefits, recycling has symbolic and educational value. On many campuses, it is often the most visible sign of the institution's commitment to the environment. Even in states where recycling is required by law, recycling bins in classrooms and corridors translate into a positive message about resource conservation.

When the general public thinks of "recycling, they typically envision metal cans, glass or plastic bottles, newspaper, cardboard and office paper. But campuses, as this section illustrates, can recycle much more. Campus facilities and departments recycle or recover a wide variety of wastes such as scrap metal, lead-acid batteries, used oil, freon-based refrigerants, power plant ash, carpeting, lab plastics and fluorescent light bulbs. And embracing the adage, "If you're not buying recycled, you're not recycling," a growing number of campuses, including Rutgers University and the University of Illinois, are "closing the loop" and reaping financial benefits by recycling paper, motor oil and other items and then repurchasing these same products in recycled form.



Award-Winning Materials Recovery Program

University of Colorado

The recycling program at the University of Colorado (CU) was launched as a student enterprise in 1976. Since then it has become a complex partnership program engaging facilities employees, a professional staff and hourly student workers. Jack DeBell has directed the nationally recognized program since 1984. Collection of recyclables is handled by facilities management personnel, but most other functions are carried out by an energetic cadre of graduate and undergraduate students. Students staff the on-campus recycling processing center, and they also prepare materials for market, manage all contracts and coordinate campus outreach and research related to the recycling program. While the facilities management department and student government each has its own budget for recycling, only the student side of the equation is covered here.

Most of the program funding comes from a small fee assessed per student (\$1.50 in the 1996-97

school year) and from revenues generated from materials sales. The recycling program also brings in grants and conducts contract research. Based on records kept since 1980, the program has earned more than \$505,000 in revenues. Over the past 3 years, it has saved around \$150,000 in disposal costs.

To date, the CU program has diverted more than 9,880 tons of recyclable paper, cardboard, metals, glass and plastic from the local landfills.

To date, the CU program has diverted more than 9,880 tons of recyclable paper, cardboard, metals, glass and plastic from the local landfills. In 1996, newsprint made up 37 percent of the recycling tonnage, followed by office paper (24 percent), cardboard (19 percent) and white paper (9 percent). Recyclable glass, steel, aluminum and plastic containers accounted for 11

percent of the tonnage.

According to DeBell, the future of the program looks bright. "The combination of interdepartmental coordination and support from the administration," he says, "plus a supportive and committed student body, will get campus recycling through the nineties." He is also hopeful that policy makers, manufacturers and the public will nurture the infrastructure needed for a "greatly enhanced future for recycling."

Recovering and Recycling Materials

Cost Savings

Materials <u>recycled</u>	Revenue <u>generated</u>	Avoided costs <u>of landfill disposal</u>	Annual <u>savings/revenue</u>
1,087 tons	\$55,000	\$52,000*	\$107,000**

*Includes tipping fee (\$18/ton), custodial and transport costs.

** Figure does not include annual revenues from student fees.

While recycling tonnages have increased in recent years, their market value has generally declined. Revenue shortfalls have resulted because of depressed prices, especially for newsprint and cardboard, but those have been offset by the student fee revenues. Had CU's program received the same prices for its materials in 1996 that it received in 1992, it would have returned a surplus to the campus.

CU not only recycles but also uses its considerable expertise to teach about recycling, sponsoring internships, independent studies and more than 15 class projects each year. In addition, the campus runs one of the nation's only certification programs for recycling operations and outreach. The blend of academic training and hands-on recycling experience gives CU's graduates an edge in an increasingly competitive job market, and former students manage municipal and corporate recycling programs all over the country. In 1995, in recognition of its leadership in this field, CU received the first-ever award for the Outstanding School Recycling Program of the Year from the National Recycling Coalition.

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Photo by Fritz Myer

Dining Services Recycling

Harvard University

The six kitchen facilities that comprise Harvard University's Dining Services serve an average of 15,000 meals a day and generate a lot of waste, despite numerous intensive waste reduction efforts. In the early 1990s, notes Rob Gogan, Waste Manager for Facilities Maintenance Operations (FMO), the high cost of trash disposal was expected to keep climbing. Working in partnership with Alexandra McNitt, Project Manager of Dining Services, Gogan expanded the campus recycling program in late 1993 to include the six dining facilities. As a result, steel and aluminum cans, glass and plastic food containers, and substantial quantities of cardboard were taken out of the waste stream.

Prior to recycling, the annual cost for trash disposal had reached nearly \$180,000. Three years later, following the initiation of an aggressive recycling and waste reduction program, costs



Alexandra McNitt, Harvard University

dropped by 20 percent. And this reduction came over a period when University per-ton disposal fees had increased by 24 percent. Without the program, Gogan estimates that Dining Services would have paid around \$79,000 more for trash disposal in 1996 than it actually did.

Reduction in Waste Disposal Charges Due to Recycling

Cost Savings

Trash Disposal Charges at Harvard University Dining Services

FY 1991	\$170,920
FY 1992	\$170,090
FY 1993	\$178,890
FY 1994*	\$162,710
FY 1995	\$138,420
FY 1996	\$142,548

1996 estimate <u>without recycling**</u>	1996 actual <u>cost</u>
\$221,824	\$142,548

Annual cost savings \$79,275

*First full year of recycling program.

**Based on a 24% increase over 1993 charges.

Other steps taken to reduce food service waste include distributing reusable mugs to all incoming first-year students and requiring all shippers who deliver goods on wooden pallets to take empty pallets when they leave the campus.

Dining Services is also working to divert food waste that it currently sends down the drain. Existing food grinders require large amounts of increasingly expensive water. The resulting wastewater increases the biological oxygen demand at the local sewage treatment facility, reducing the plant's efficiency. To lessen the environmental impact and to save money on water, Harvard has begun installing food pulpers in its kitchens. These pulpers spin the waste 50 percent dry and deliver it to a steel container at the loading dock; from there the waste is picked up on a daily basis and taken to a commercial composting facility. As of fall 1997, two of the six facilities had begun the program, diverting an estimated five tons of compostable material each month.

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Getting Top Dollar from Paper Recycling

University of Wisconsin

While other programs complain about how recycling doesn't pay, we can tell a different story — good prices, high participation rates and very little contamination.

When the University of Wisconsin-Madison's (UW) first office paper recycling contract was up for renewal in 1993, Environmental Management Coordinator, Daniel Einstein looked around for a better deal. Under the old contract, the University was paying Waste Management, its recycling contractor, a monthly average of \$4,000 in tipping fees and received no revenue regardless of the market value of the materials.

Realizing that high-value materials could be generating income, especially with improved market prices for paper, Einstein hired a graduate student to develop a new approach for requesting and reviewing bids on the right to buy the University's paper for recycling. Using the new approach, a contract was awarded to a local vendor, Madison Recycling, to handle all of UW's paper recycling,

including newsprint and cardboard. Under the new contract, UW stopped paying tipping fees for pick-up of materials and started to generate income according to current market prices.

Under the new contract, which establishes a floor price of zero dollars in the monthly transaction for cardboard, newspaper and other lower grades of paper, the University is protected in times of extreme volatility in the commodities markets. Prices for cardboard, for instance, have ranged from a high of \$180 per ton in the spring of 1995 to a low of \$20 per ton 6 months later. For mixed office paper the contract establishes a positive floor price (currently \$10 per ton), guaranteeing income even if the market for this grade of paper collapses. The new contract also prohibits vendors from dumping or refusing to accept the product during poor markets and ties the value paid to the University to a published market sheet, protecting both buyer and seller.

The result is an impressive savings for the University. The new contract has generated an average of \$6,000 per month since the spring of 1994, with revenues ranging from \$20,000 in May 1995 to \$1,088 in June 1997. "While other programs complain about how recycling doesn't pay," Einstein notes, "we can tell a different story — good prices, high participation rates and very little contamination." "It really does work!"

A New Paper Recycling Contract for New Revenues

Cost Savings

	Tipping fee/ month	Revenue/ month	Average fee/ year	Average revenue/ year
Old Contract	\$4,000	0	\$48,000	0
New Contract	0	\$6,000	0	\$72,000

Annual savings/revenue \$120,000*

*Based on 3 year average (1994-1997).

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Analyzing Wastes to Cut Costs

University of Wisconsin

For some time, the University of Wisconsin-Madison (UW) has had a contract for sale of recyclable commingled containers (aluminum, steel, glass and plastic) generated by University housing and the student unions. The contract in effect until March 1997 stipulated that per-ton revenues for sale of the materials would be the same as the amount paid to municipal and commercial contract-holders. This revenue rate was very low because of the high proportion of glass — which is high in weight but low in value — in the municipal and commercial material streams.

Recycling Coordinator, Daniel Einstein, however, realized that UW's commingled mix had a much higher percentage by weight of the more valuable aluminum cans than did the average municipal or commercial material stream. Einstein set out to verify his theory and to win the University new contract terms.

Samples of commingled material from residence halls, family housing and two student unions were collected in the fall of 1996 and the spring of 1997. A crew of undergraduate students was hired and trained to conduct the sorting study. Analysis of 17 samples weighing 275 pounds each proved,

as expected, that the mix was significantly richer in aluminum than the municipal/commercial material stream. The study cost the University only \$1,000.

Following the waste study, the recycling contractor granted a much higher revenue rate for the commingled mix collected from housing and unions, resulting in a payout of nearly \$2,000 per month. Previously, University housing and the unions received only \$100 per month for their materials.

In reminiscing about the study, Peter Wold, Program Assistant for Environmental Management, notes that sorting through over two tons of sticky cans and bottle was a dirty, noisy job. "But without the hard work from our student sorters, we would never have been able to prove that the University was being underpaid for its mixed containers."

Sorting through over two tons of sticky cans and bottle was a dirty, noisy job. But without the hard work from our student sorters, we would never have been able to prove that the University was being underpaid for its mixed containers.

Revised Contract for Commingled Recyclables

Cost Savings

	Monthly <u>revenue</u>	Annual <u>revenue</u>
Old Contract (34 month avg.)	\$100	\$1,200
New Contract (4 month avg.)	\$1,850	\$22,200
Annual savings/revenue		\$21,000

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Contracting for Environmental Improvement

Rutgers University

In the past, vendors contracted to provide goods and services to Rutgers University under standard business terms. That meant that when they delivered their products to a loading dock, they drove away with no further thought about any associated wastes and hazards. Any environmental problems down the line would be the University's, not theirs. That business-as-usual approach cost the University millions in handling and disposal costs — but no longer.

Senior Purchaser, Kevin Lyons has helped to institute a whole new way of doing business on campus, and today vendors who bid to supply products or services to Rutgers University know they had better read the terms of their contracts carefully. Under Rutgers' innovative Environmental Contract Management (ECM), all University contracts now contain language requiring vendors to help the University minimize waste and maximize environmental responsibility.

As Lyons puts it, most campuses focus on the "small stuff," looking to achieve resource conservation in a single contract or project. His strategy has been to look at the big picture. "You

have to attack the whole system," he says. Using techniques such as life cycle analysis, Lyons has set up systems to monitor and track nearly all goods coming into and leaving the three Rutgers campuses. Before a contract is awarded, an agreement must be reached that stipulates the vendor's responsibility to minimize or remove wastes. Initially, it took quite an effort to have this approach adopted campus-wide. But, as Lyons notes, "We made it mandatory and now we just do it."



Kevin Lyons

Lyons sees ECM as tying directly into Rutgers' role in protecting the environment and educating environmentally literate citizens, and he notes that contracts can reflect the University's values. Many students work with him and are on the lookout for new environmental opportunities. To make environmental procurement policies cost-effective, Lyons also works with campus engineers and scientists to design products and systems that are better than conventional versions. He pioneered the use of reusable blankets for shipping office furniture, for example, significantly cutting the amount of cardboard used. Often the exact savings are not tracked, but both vendors and the University "know" that total costs are lower than before.

Since 1989 Rutgers' ECM initiatives have helped to save millions of dollars, and Lyons has carried the message of "big picture" change off-campus as well. He has shared ECM concepts with industry, government, academic institutions and members of the National Association of Educational Buyers (NAEB), a co-sponsor of this report. He is confident that ECM will eventually become standard procurement practice.

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THE LAST TWO CENTS

If the volume of literature on sustainability in higher education and the number of campus task forces on the environment are any measure, the 1990s have been a watershed decade for campus environmental awareness. In classrooms, conferences and rallies students and faculty have studied the threats to the planet and the opportunities for addressing them. The greatest challenge to emerge from this flurry of activity, may be that of channeling new-found knowledge and growing concern into positive solutions.

The students, faculty and staff featured in *Green Investment, Green Return* have met that challenge. These pioneers of campus ecology have had to think outside the boundaries of academic disciplines. They have fostered collaboration across unfamiliar lines, identified and overcome numerous obstacles and worked a little harder to keep better records. They have learned to arrange financing, alter contracts, redesign equipment and procedures, educate one another, document results, and more.

Frequently, these innovators have found and employed new "off the shelf" technologies — efficient lighting and toilets, movement-sensors, photovoltaic panels, and in-vessel composting systems. But technology alone has not provided a simple "quick fix" to the problems of pollution and depletion of resources. Students and staff have had to adapt technologies to varying conditions, to affect behaviors and to make convincing arguments for changing the status quo.

Kermit the frog may have misled people a bit when he said, "It's easy being green." For the campuses depicted here, being green has not been easy. It has required hard work, clear thinking and focused determination. But with persistence and creativity, campus innovators have demonstrated that even seemingly intractable issues and deeply ingrained behaviors — such as generating hazardous waste in labs and driving alone to campus — will yield to more sensible alternatives.

And in pursuing their projects, they have demonstrated that the benefits of campus greening — in terms of reduced resource consumption pollution and costs — can be surprisingly significant. Who would have guessed that toilet replacements and other water conservation projects at one medium-sized university would cut annual water use by almost 60 million gallons or that one dining hall could save close to \$200,000 each year by reducing its use of paper cups?

As impressive as these achievements are, however, the staff, students and faculty working on these successful projects today convey anything but smug satisfaction and complacency. They are not resting on their laurels. To the contrary, the initial pursuit of a small-scale conservation project often blossoms into an expanded sense of the possible and a sharpened understanding of the details and the stimulating challenge of working toward sustainability. For Will Toor, at the University of Colorado at Boulder, for instance, the pursuit of sustainability on campus has entailed "an almost endless effort to search out and address the many disincentives to conserving resources and cutting costs." For Larry Bekelja at Elizabethtown College, the pursuit of energy efficiency continues even after several years of consistent improvements and cost savings.

The evidence points to a powerful, self-reinforcing shift in thought and action on many campuses. And beneath this report lies the hope that readers from hundreds more campuses and all types of institutions will be encouraged to emulate and improve upon the examples documented here. Clearly, institutions of higher education, with their endowment of resources, knowledge and skills, are uniquely positioned to help solve local and global environmental problems. And for a modest green investment today, campuses can help themselves and their communities reap green returns now and on into the future.

PRINT AND ELECTRONIC RESOURCES

Books & Reports

Chamberlin, Lynn K. and Kirk Conger, PE, 1995. The Intern Solution. Lincoln, NE: Nebraska Energy Office.

Collett, Jonathan and Stephen Karakashian, editors, 1996. Greening the College Curriculum: A Guide to Environmental Teaching in the Liberal Arts. Washington, DC: Island Press.

Creighton, Sarah Hammond, in press. Greening the Ivory Tower: Improving the Environmental Track Record of Colleges and Universities. Cambridge, MA: MIT Press.

Eagan, David J. and David W. Orr, editors, 1992. The Campus and Environmental Responsibility in New Directions for Higher Education, No. 77. San Francisco, CA: Jossey-Bass.

Eleven chapters cover some of the earliest campus environmental projects, including the environmental audit at UCLA, food-buying initiatives at Hendrix and St. Olaf Colleges, energy conservation at Brown University, the University of Kansas Environmental Ombudsman program, environmental literacy at Tufts University, campus recycling and the student environmental movement.

Heinz Family Foundation, 1995. Blueprint for a Green Campus: The Campus Earth Summit Initiatives for a Green Campus. Washington, DC: Heinz Family Foundation.

Gives recommendations for greening the campus community, ranging from purchasing policies and waste management to student activism and curricular changes. On the Internet at <http://www.cgv.org/cgv/blueprint/homepage.html>

Keniry, Julian, 1995. Ecodemia: Campus Environmental Stewardship at the Turn of the 21st Century. Washington, DC: National Wildlife Federation.

Comprehensive review and case study presentation of campus environmental initiatives nationwide. Covers purchasing, landscaping, transportation and fleet maintenance, energy, dining services, communication, solid waste, hazardous waste and campus stewardship programs.

Koester, Robert J., editor, 1997. Greening of the Campus II: The Next Step, Conference Proceedings, Volume 2, September 18-20, 1997. Muncie, IN: Ball State University.

44 papers in 15 categories including curriculum transformation, physical plant, energy conservation, student-initiated projects, campus transportation, recycling and re-use and campus landscaping. See Internet site: <http://www.bsu.edu/events/events2/green1.html#next>

Koester, Robert J., editor, 1996. Greening of the Campus, Conference Proceedings, Volume 1, April 4-6, 1996. Muncie, IN: Ball State University.

50 papers and abstracts on curricular initiatives, environmental literacy, campus stewardship programs, energy conservation, facilities improvement, recycling, sustainability, international initiatives and landscaping.

Orr, David W., 1994. Earth in Mind: On Education, Environment and the Human Prospect. Washington, DC: Island Press.

Essays on conservation, environmental education, the role of higher education and ecological design.

Orr, David W., 1992. Ecological Literacy: Education and the Transition to a Postmodern World.

Albany, NY: State University of New York Press.

Critical essays on sustainability, the value of environment in the liberal arts and a vision of curriculum predicated on place.

Second Nature and ULSF, 1995. Workshop on the Principles of Sustainability in Higher Education. Essex, MA: Second Nature Publications.

Developed under the auspices of the President's Council on Sustainable Development Public Linkage, Dialogue and Education Task Force, this report underscores the importance of higher education in achieving a sustainable society. Available at <http://www.2nature.org>

Simpson, Walter, 1995. UB Guide to Green Computing. Buffalo, NY: SUNY Buffalo.

This brief report gives useful tips for conserving energy and paper used by campus computers. For copies, write Simpson at University Facilities, 133 Helm Bldg., SUNY Buffalo, Buffalo, NY 14260. Make \$2 check payable to SUNY Buffalo. For an Internet copy, see <http://www.wings.buffalo.edu/services/recycling/BOOKLET/>

Smith, April and the Student Environmental Action Coalition, 1993. Campus Ecology: A Guide to Assessing Environmental Quality and Creating Strategies for Change. Los Angeles, CA: Living Planet Press.

Step-by-step guide for conducting environmental audits of colleges and universities. Includes case examples of effective campus environmental initiatives. For copies, contact Campus Outreach, National Wildlife Federation, 8925 Leesburg Pike, Vienna, VA 22184. (703) 790-4322.

Strauss, Benjamin H., 1996. The Class of 2000 Report: Environmental Education, Practices, and Activism on Campus. New York, NY: Nathan Cummings Foundation.

Contact the Environment Program, Nathan Cummings Foundation, 1926 Broadway, Suite 600, New York, NY 10023-6915, (212) 787-7300. Also on the Internet at <http://www.2nature.org/ncf2000/>

Student Environmental Action Coalition, 1991. Student Environmental Action Guide. Berkeley, CA: Earth Works Press.

A compendium of ideas for campus projects on all topics, well-supported with success stories from colleges and universities nationwide.

Wixom, Robert L., Lisa L. Gould, Susan Schmidt and Louis Cox, editors, 1996. Environmental Challenges for Higher Education: Integrating Sustainability into Academic Programs. Burlington, VT: Friends Committee on Unity with Nature.

A compilation of essays culminating from the Friends Association for Higher Education (FAHE) symposium "Sustainable Development in Higher Education — A Challenge for Educators by the Year 2000."

Articles

Brough, Holly, 1992. "Environmental Studies: Is It Academic?"

WorldWatch, Vol. 5, No. 1: p. 26-33.

Capone, Lisa, 1991. "Magna cum Environmentalist: The Environmental Imperative in Higher Education."

E Magazine, Vol. 2, No. 2.

Cortese, Anthony D., 1992. "Education for an Environmentally Sustainable Future."

Environmental Science Technology, Vol. 26, No. 6.

Cortese, Anthony D., 1997. "Engineering Education for a Sustainable Future."

Joint conference on Engineering Education and Training for Sustainable Development co-sponsored by the WFEP, UNEP, WBCSD and the ENPC, Paris. Available through Second Nature (see co-sponsor contact and resource list).

Keniry, Julian, 1993. "Environmental Movement Booming on Campuses."

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Orr, David W., 1992. "What is Education For?"

Earth Ethics, Vol. 3, No. 3, Spring.

Orr, David W., 1990. "The Liberal Arts, the Campus, and the Biosphere."

Harvard Educational Review, Vol. 60, No. 2: p. 205-216.

Perrin, Noel, 1992. "Colleges are Doing Pitifully Little to Protect the Environment."

The Chronicle of Higher Education, Vol. 39, No. 10, p. B3, October 28.

Simpson, Walter, 1996. "Environmental Stewardship and the Green Campus."

Facilities Manager, January.

Internet World Wide Web Sites

These Internet sites are a starting point for ideas and inspiration on campus environmental initiatives. They contain program information and history, campus policies, student reports, environmental resources and links to other useful sites.

Campus Ecology (National Wildlife Federation, Washington, DC)

<http://www.nwf.org/nwf/campus/>

Brown is Green (Brown University, Providence, RI)

http://www.brown.edu/Departments/Brown_Is_Green/

Environmental Center (University of Colorado, Boulder, CO)

<http://www.Colorado.EDU/cuenvironmentalcenter/>

Green University Initiative (The George Washington University, Washington, DC)

<http://www.gwu.edu/~greenu/>

UB Green — Campus Environmental Stewardship (SUNY, Buffalo, NY)

<http://www.wings.buffalo.edu/services/recycling/>

WatGreen — Greening the Campus (University of Waterloo, Ontario)

<http://www.adm.uwaterloo.ca/infowast/watgreen/>

Green Lights — Energy Star Program (U.S. Environmental Protection Agency, Washington, DC)

Look for information on college and university "partners" in the program.

<http://www.epa.gov/greenlights.html/>

Energy Star Hotline: (202) 775-6650

Blueprint for a Green Campus (Report of the 1994 Campus Earth Summit at Yale University)

<http://www.cgv.org/cgv/blueprnt/homepage.html>

The Class of 2000 Report (by Ben Strauss and the Nathan Cummings Foundation)

<http://www.2nature.org/ncf2000/>

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Washington, DC 20036
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fax: (202) 833-2467
<http://www.aacc.nche.edu>

Association of College and University Housing Officers International (ACUHO International)

364 West Lane Avenue
Suite C
Columbus, OH 43201-1062
phone: (614) 292-0099

The Association of Higher Education Facilities Officers (APPA)

Attn: Wayne Leroy, Executive Vice President
1643 Prince Street
Alexandria, VA 22314-2818
phone: (703) 549-2772
<http://www.appa.org>
An international association dedicated to
maintaining, protecting and promoting the quality
of educational facilities.

Campus Outreach Opportunity League (COOL)

Attn: Melissa Kendrick
1511 K Street NW
Suite 307
Washington, DC 20005
phone: (803) 777-9596
<http://www.cool2serv.org>

Center for Respect of Life and Environment (CRLE)

Attn: Wynn Calder
2100 L Street, NW
Washington, DC 20037
phone: (202) 778-6133
e-mail: CRLE@aol.com

<http://www.center1.com/crle.html>
CRLE, founded in 1986, promotes the greening of
higher education and fosters earth ethics to guide
sustainable development.

Consortium for Environmental Education in Medicine (CEEM)

Attn: Madaleine R. Ochinang, Program Director
44 Bromfield Str., 5th Floor
Boston, MA 02108
phone: (617) 292-0094
<http://www.ceem.org>

The Nathan Cummings Foundation

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Free The Planet

Attn: Loren Sinkelstien, Program Director
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Washington, DC 20003
phone: (202) 547-3656
e-mail: freetheplanet@essential.org
<http://www.essential.org/freetheplanet/home.html>
A grassroots network of student activists working to
end polluter lawlessness and government inaction.

National Association of Educational Buyers Inc. (NAEB)

Attn: Joan Fox, CAE, Executive Director
450 Wireless Boulevard
Hauppauge, NY 11788
phone: (516) 273-2600
<http://www.naeb.org>
NAEB's mission is to advocate the development,
exchange, and practice of effective and ethical
procurement principles and techniques within the
higher education community.

Office of Sustainability Programs, University of New Hampshire

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Second Nature

Attn: Anthony Cortese, President
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Boston, MA 02108
phone: (617) 292-7771
<http://www.2nature.org>
A non-profit organization whose mission is to
expand the capacity of colleges and universities to
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Sierra Student Coalition

145 Waterman Street
1st Floor
Providence, RI 02906
phone: 1-800-JOIN-SSC
e-mail: ssc-info@ssc.org
<http://www.ssc.org>
A student run program of the Sierra Club that helps
students become more effective activists through
training programs and campaigns.

Society for College and University Planning (SCUP)

4251 Plymouth Road
Ann Arbor, MI 48105-2785
phone: (734) 998-7832
fax: (734) 998-6532
e-mail: scup@umich.edu
<http://www.scup.org>
SCUP is the leading organization focused on
planning in higher education, at all levels and in all
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and quality of higher education, especially during
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Clemson University/Medical University of
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Association of University Leaders for a Sustainable Future (ULSF)

2100 L Street, NW
Washington, DC 20037
phone: (202) 778-6133
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<http://www.ulsf.org>
An affiliate of CRLE, ULSF's mission is to unite adminis-
trators, faculty, staff and students in collaborative
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World Resources Institute/Management Institute for Environment and Business (WRI/MEB)

Attn: Allison Clifford, Program Assistant
1709 New York Avenue, NW
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phone: (202) 434-1985
<http://www.wri.org/wri/meb>
MEB works to make business people partners in
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David J. Eagan, PhD

Julian Keniry

ABOUT THE AUTHORS

David Eagan, PhD has been active in the campus environmental movement both on his home campus — the University of Wisconsin-Madison — and nationally. In 1992 he co-edited with David Orr *The Campus and Environmental Responsibility*, a book of college and university case stories. From 1992 to 1995, he taught a project-based seminar for seniors in environmental studies, working with campus staff to tackle institutional environmental problems. He has presented his research on campus-focused student projects at several national conferences. David currently runs a green-building project at UW-Madison, which will incorporate technical and behavioral changes to conserve energy, water and other resources in the University's 110-year old science hall. He holds a doctorate in educational administration from UW-Madison.

Julian Keniry manages the Campus Ecology Program for the National Wildlife Federation and oversees a staff of six, including five regional field coordinators who serve college campuses across the country. Working within the Campus Ecology Program since 1989, Julian has written various publications on sustainability in higher education. She also is the author of the 1995 National Wildlife Federation book, *Ecodemia: Campus Environmental Stewardship at the Turn of the 21st Century*. Formerly a member of the "Greening of the White House" task force, Julian has served as an advisor to the Environmental Protection Agency on issues of environmental education and has traveled widely around the globe promoting a message of environmental stewardship in higher education. She is currently on the Board of the Institute for Conservation Leadership.

THE NATIONAL WILDLIFE FEDERATION'S CAMPUS ECOLOGY PROGRAM

For over eight years, the **Campus Ecology Program** has been a cornerstone initiative in higher education, promoting ecological stewardship on campuses and in their surrounding communities. Since the program's founding in 1989, the National Wildlife Federation has provided regional field coordinators, a growing library of educational materials and other support to the students, staff and faculty across the country working on projects ranging from composting to recycling. The **Campus Ecology Program** is committed to fostering student, staff and faculty leadership in developing and implementing sustainable practices in higher education and in extending these models to the greater community.

In addition to educational materials and training, Campus Ecology offers a formal enrollment program whereby students, faculty and staff work with Campus Ecology field coordinators to develop tangible project goals for the academic year and beyond; complete detailed project surveys, including reviews of accomplishments; develop components of environmental management systems; act as bridges to local communities; host trainings; and more. Enrolled programs are featured in the *Campus Environmental Yearbook*, an annually published electronic resource on the World Wide Web.

For more information about the program, its staff, resources and services, see the National Wildlife Federation's website at <http://www.nwf.org/campus>, write to the National Wildlife Federation's **Campus Ecology Program** at 8925 Leesburg Pike, Vienna, VA 22184, or call Campus Ecology's information line at (703) 790-4318 to order a free copy of the *Campus Ecology Project Action Toolkit: A Complete Guide to Resources for Greening Your Campus*. Additional resources may be ordered through the toolkit, including *Ecademia: Campus Environmental Stewardship at the Turn of the 21st Century*, 1995, 221 pp; the 1998 *Conservation Directory*; and *Project Resource Packets* on ten topics: sustainable transportation, campus watershed, composting, ecological building design, environmental justice and injustice, four Rs, fundraising, greenscapes, food issues and procurement.

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